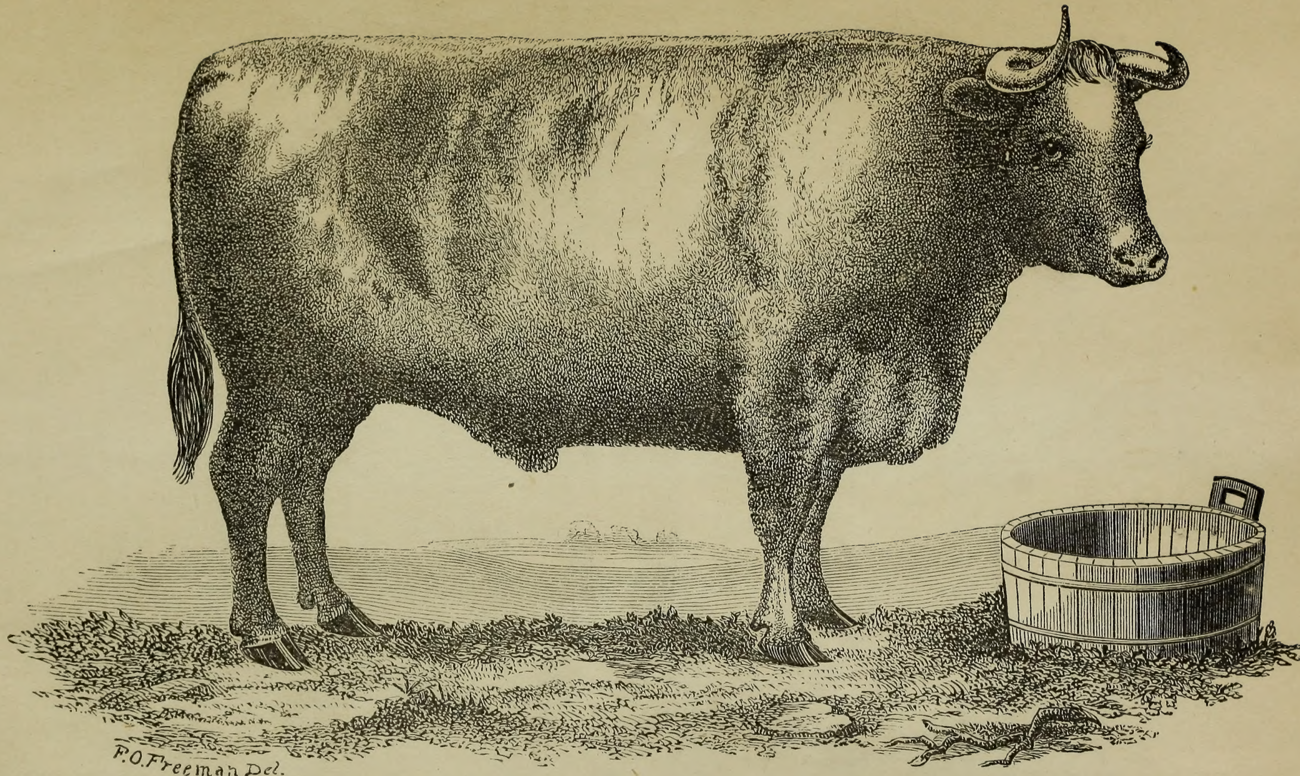

Grade Short-horned Ox
Five years old. Weight 3851 lbs.

"CONSTITUTION"

Bred by John Sanderson,
Bernardston, Mass.

PHOTOGRAPHED BY ELY.

37TH CONGRESS, 3d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 78.

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1862.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1863.

HOUSE OF REPRESENTATIVES, *March* 3, 1863.

Resolved, That there be printed by the Superintendent of Public Printing, under the direction of the Commissioner of Agriculture, one hundred thousand extra copies of the report of the Department of Agriculture for 1862, for the use of this present House, and twenty thousand extra copies for distribution by that department.

Attest: EM. ETHERIDGE, *Clerk.*

REPORT

OF THE

COMMISSIONER OF AGRICULTURE.

AN ACT TO ESTABLISH A DEPARTMENT OF AGRICULTURE.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established at the seat of government of the United States a Department of Agriculture, the general designs and duties of which shall be to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word, and to procure, propagate, and distribute among the people new and valuable seeds and plants.

SEC. 2. *And be it further enacted,* That there shall be appointed by the President, by and with the advice and consent of the Senate, a "Commissioner of Agriculture," who shall be the chief executive officer of the Department of Agriculture, who shall hold his office by a tenure similar to that of other civil officers appointed by the President, and who shall receive for his compensation a salary of three thousand dollars per annum.

SEC. 3. *And be it further enacted,* That it shall be the duty of the Commissioner of Agriculture to acquire and preserve in his department all information concerning agriculture which he can obtain by means of books and correspondence, and by practical and scientific experiments, (accurate records of which experiments shall be kept in his office,) by the collection of statistics, and by any other appropriate means within his power; to collect, as he may be able, new and valuable seeds and plants; to test, by cultivation, the value of such of them as may require such tests; to propagate such as may be worthy of propagation, and to distribute them among agriculturists. He shall annually make a general report in writing of his acts to the President and to Congress, in which he may recommend the publication of papers forming parts of or accompanying his report, which report shall also contain an account of all moneys received and expended by him. He shall also make special reports on particular subjects whenever required to do so by the President or either house of Congress, or when he shall think the subject in his charge requires it. He shall receive and have charge of all the property of the agricultural division of the Patent Office in the Department of the Interior, including the fixtures and property of the propagating garden. He shall direct and superintend the expenditure of all money appropriated by Congress to the department, and render accounts thereof, and also of all money heretofore appropriated for agriculture and remaining unexpended. And said Commissioner may send and receive through the mails, free of charge, all communications and other matter pertaining to the business of his department, not exceeding in weight thirty-two ounces.

SEC. 4. *And be it further enacted,* That the Commissioner of Agriculture shall appoint a chief clerk, with a salary of two thousand dollars, who in all cases during the necessary absence of the Commissioner, or when the said principal office shall become vacant, shall perform the duties of Commissioner, and he shall appoint such other employés as Congress may from time to time provide, with salaries corresponding to the salaries of similar officers in other departments of the government; and he shall, as Congress may from time to time provide, employ other persons, for such time as their services may be needed, including chemists, botanists, entomologists, and other persons skilled in the natural sciences pertaining to agriculture. And the said Commissioner, and every other person to be appointed in the said department, shall, before he enters upon the duties of his office or appointment, make oath or affirmation truly and faithfully to execute the trust committed to him. And the said Commissioner and the chief clerk shall also, before entering upon their duties, severally give bonds with sureties to the Treasurer of the United States, the former in the sum of ten thousand dollars, and the latter in the sum of five thousand dollars, conditional, to render a true

and faithful account to him or his successor in office, quarter-yearly accounts of all moneys which shall be by them received by virtue of the said office, with sureties to be approved as sufficient by the Solicitor of the Treasury; which bonds shall be filed in the office of the First Comptroller of the Treasury, to be by him put in suit upon any breach of the conditions thereof.

Approved May 15, 1862.

REPORT.

DEPARTMENT OF AGRICULTURE,
Washington, January 1, 1863.

In compliance with the foregoing law organizing the Department of Agriculture, I have the honor to submit my first annual report. In so doing, I have deemed it not inappropriate to offer some observations on the magnitude of the interests intimately connected with, or growing out of agriculture, the most ancient, the most honorable, and the most indispensable of all the occupations of man, and to give a rapid glance at the improvements which successive ages have wrought in this department of knowledge, and the progress made in our country in later years, as well as the special operations of this department since its organization.

Agriculture in its first inception could scarcely be considered as an art, or even occupation. The ancients, deriving their food chiefly from the spontaneous productions of the soil, styled the earth their mother; but we, in the light of a higher philosophy, are reminded by our own harvest home and finished year, of our obligations to one common Father, who gives "rain from heaven and fruitful seasons, filling our hearts with food and gladness." Health has everywhere prevailed; and notwithstanding the temporary transfer of large numbers of our patriotic countrymen from their farms to the ranks of the army and navy, yet the great interests of agriculture in the loyal States have not materially suffered. Abundant crops of the cereals and other grains, of grasses, of roots and fruits, have been garnered. Besides feeding the settled and increasing population of the country and our immense land and naval forces, we have exceeded the exportation of any previous year by over 17,000,000 of bushels of grain.

Agriculture, whether viewed as an art or science, presents a history as marked and important as that of any other great civilizer in the world's progress. In its rudest state men subsist, for the most part, upon the chase, or such roots, fruits, and grains as are easily gathered. In its second stage men follow the pastoral life, wherein as nomadic tribes, inhabiting hilly countries or table-lands, they depend chiefly upon flocks and herds for food, raiment, and locomotion. In Central Asia—that mysterious source of languages, religions, and races—this condition of agriculture has ever prevailed. Next, increase of population, demand for food, richness of soil, and the spirit of adventure, have forced or attracted men to the now celebrated alluvial plains of the world. Finally, from the great centres of modern population the same

migrations of races are taking place as of old; planting new empires in the wilderness, and making a superior agriculture—whether in hilly countries, table-lands, or alluvial plains—the great and essential art of life.

As history is philosophy teaching by example, it would be highly instructive to discuss the condition of influence of agriculture as exhibited in the life of the two great nations of classical antiquity. For want of space, let us select for instruction the one which in magnitude, soils, wealth, power, energy, enterprize, and institutions resembled most our own republic. After a splendid career of prosperity, filling the world with her fame, Rome culminated and declined. No historical proposition is more susceptible of proof than that the great causes of that decline were the laws enacted affecting real estate and the condition, skill, and products of labor. For many years after Rome had grown to greatness, the cultivation of the soil was not only deemed honorable, but was regulated by law, in order that agriculture might yield the largest return to labor, and be, in reality, the great conservator of the empire. Not only were flocks and herds kept for food and raiment, and alluvial lands tilled, but the soils in more unfavorable regions were carefully and skilfully cultivated. At first the allotment of land to each citizen was but six acres. It was not ploughed, but spaded, and the yield was very great. Virgil, Cato, and Columella, Rome's chief agricultural writers, invariably urge the cultivation of small farms, in order that the tillage may be thorough. The subdivision of estates, the limitation of their extent, and the habit of personal attention to farming, were excellent conditions for success. "The Romans," says Frederick Von Schlegel, referring to the last days of the republic, "were a thoroughly agricultural people." Changing this splendid basis of prosperity, permanency, and power, whereby, resting in the soil, Rome pierced the heavens by the force of thought, she grew proud and oppressive; the reins of power slipped from the hands of the middle classes; labor became disreputable; the soil a monopoly, and the masses of the people reckless, unpatriotic, and degraded. A few proprietors held the land and owned the labor. The poverty of the many, with its evils of want, of ignorance, and dependence, existed by the side of the excessive wealth and culture of the few. The lands in Italy and in the conquered provinces were apportioned among the families of the great, instead of being given or sold as free homesteads to the poor. By this unequal distribution of property, and by forcing the husbandman into the army and buying up or taking his land, much of the soil was cultivated by servile labor. This monopoly of the land and condition of labor operated unfavorably to agriculture, and thus to the prosperity and permanency of the empire. These two causes were destructive to intelligent, interested, and really productive agriculture. Certain staples, it is true, were raised in vast quantities; but these required little skill, and prevented the cultivation of a variety of crops. Old and exhausted lands were abandoned without any attempt to renew their fertility. The laborer felt no moneyed interest, no personal pride, in the result of his toil, and all generous progress in agriculture was retarded. The

voice of history proclaims, in the clearest manner, that free labor and ownership of the soil by the laborer, if possible, are necessary conditions to the highest success in agriculture and national prosperity. Give the laborer no interest, prospective or otherwise, in the soil he tills, and he cannot be otherwise than wasteful and inefficient.

In the earlier days of the empire the maximum limitation of freeholds to 500 acres, in connexion with the old Roman love of agriculture, led to a careful and exact mode of culture. But in the later days of the empire, says Hallam, "the laboring husbandman, a menial slave of some wealthy senator, had not even the qualified interest in the soil which the tenure of villanage afforded to the peasant of feudal ages." At this period, notwithstanding Rome's matchless soil and climate, she was compelled to import food from her conquered provinces. Rome remained free while her middling classes retained a controlling influence; but when the tenure of the soil passed into the hands of the few, the incentives to industry, to order, and to a quiet life were gone. Her young men sought the excitement of the camp, the city, or foreign lands. Cut loose from the ties of home, and maddened by the bad example of the landed aristocracy, the poorer classes lost their old love of country and liberty. The mad prodigality which prevails in the confusion of a shipwreck may serve to explain the progress of luxury amid the misfortunes and terrors of a sinking nation. Some of the landed proprietors, at the period of which we speak, owned estates of such magnitude that, though tilled by slaves, the annual revenue of each amounted to nearly $3,000,000, which was squandered by the nobles in every excess of luxury. "Rivers," says Seneca, "which had divided hostile nations flowed, during this period, through the vast estates of private citizens." Read but the following graphic descriptions from the pen of Ammianus, the Roman, after the lands had been monopolized by the few, and agriculture degraded by servile labor, and say if here was not cause enough for Rome's ruin and warning to America! "A secure and profound peace succeeded the tumults of the republic. Distant nations revered the name of the people and the majesty of the Roman senate. But this native splendor was degraded and sullied by the conduct of those who displayed the rent-rolls of their estates, and provoked the just resentment of every man who recollected that their poor and invincible ancestors were not distinguished one above another. Whenever these rich land owners visited public places they assumed a tone of loud and insolent command towards their equals, and appropriated to their own use the conveniences designed for the Roman people."

"Owing to the degradation of labor," says Gibbon, "the plebeians disdained to work with their hands, and the husbandman, being obliged to abandon his farm during the term of his military service, soon lost his zest for work. The lands of Italy, which had been originally divided among the families of free and indigent proprietors, were insensibly purchased or usurped by the avarice of the nobles. In the age which preceded the fall of the republic it was computed that only 2,000 citizens were possessed of any independent subsistence.

When the prodigal, thoughtless commons had imprudently alienated not only the *use* but the *inheritance* of power—to wit, their own homesteads and free life—they sank into a vile and wretched populace!"

Such is one of the great lessons of history; and any nation that desires permanent prosperity and power should learn it well, wisely protecting labor and capital, and encouraging the division and cultivation of the soil.

There has been no *great and general* advance in agriculture in modern times till within the last thirty years. In particular localities, it is true, there was earlier improvement. In the Low Countries roots were cultivated with success, and the Dutch became celebrated for the products of the dairy. In portions of France, Germany, and Spain, the vine was extensively cultivated. But a writer who had observed extensively himself, and had access to the best information, says, in 1828, that the agriculture of continental Europe at that time was not very different from that of Britain during the middle ages.

Great Britain is indebted in a large measure to Lord Bacon for her early attention to progressive agriculture. That great thinker gave to the world inductive philosophy, which teaches man to experiment, to question, and test nature by her great alphabet of soils, gases, elements, and phenomena—a philosophy which is at once positive, progressive, and eternal, making man the "minister and interpreter of nature." It would be highly interesting and instructive to notice at length, were there space, the successive English writers on agriculture, themselves practical farmers, who accepted Bacon's philosophy, from their first publications, early in the 17th century, down to our own day. A gradual but positive improvement appears in their works and in their noble calling. Increased attention was paid to rural pursuits and the other arts, science meanwhile developing the importance of agriculture, and foreshadowing its ultimate triumph.

Early in the 18th century Jethro Tull, one of England's earliest and best writers on agriculture, recorded and published his experiments in new modes of culture. Some of his theories were erroneous, but his experiments were invaluable. Farmers are indebted to him for the horse-hoe and for drill husbandry. He also invented, but failed to perfect, the threshing machine, which, by the improvements of our own countrymen in our day, is rendered a most effective auxiliary to the labor of man. Arthur Young, who wrote in the latter part of the 18th century, was another zealous contributor to agricultural progress. He wrote and edited nearly one hundred volumes on subjects more or less directly connected with farming. He travelled extensively, both in England and on the Continent, to observe the modes of culture which prevailed. He made numerous experiments on soils to ascertain the causes of fertility, and thus prepare the way for the more scientific researches of a later period.

Many writers in Scotland, among whom Lord Kames is conspicuous, aimed to awaken a deeper interest in agriculture; but to no one is the farmer more deeply indebted than to Sir John Sinclair. At his suggestion, and under his

personal supervision, a statistical account of Scotland was undertaken, embracing a complete agricultural survey of that country. It was completed and published in forty volumes, and forms a noble monument to his perseverance and energy of character. It was followed by most important results, for it led to the establishment of the board of agriculture by Mr. Pitt, in 1793. This association brought farmers together, promoted an interchange of thought, made them acquainted with each other's mode of culture, and produced throughout the United Kingdom the stimulus which intelligent, associated effort always produces. More than all, the board was instrumental in employing Sir Humphrey Davy to make those experiments, which are not only an honor to intellect, but which established agricultural chemistry as a department of science, and of inestimable value. He delivered his lectures on this subject in 1802. The fundamental principle which he developed, and demonstrated, was this: That the productions of the soil derive their component elements which, for the most part, are hydrogen, carbon, oxygen, and nitrogen, either from the atmosphere by which they are surrounded, or from the soil in which they grow. He showed that the process of vegetation depends upon the perpetual assimilation of various substances to the organs of the plants, in consequence of the exertion of their living powers and their chemical affinities, stimulated chiefly by moisture, light, and heat. The discoveries in chemical science before Davy's time had, undoubtedly, prepared the way for his triumph, but he is none the less entitled to praise. He first recognized a plant as a living thing, the laws of whose existence were to be studied in order to develop a perfect growth. He showed, by analysis of soils and plants, what properties and conditions would best furnish the elements needed in cultivation. The success of Mr. Coke, afterwards Earl of Leicester, in the cultivation of his estate at Holkham, is a memorable instance of what scientific farming will do. When he succeeded to the estate, in 1776, large parts of it were so sterile that they were let on long leases at about seventy-five cents per acre per annum. Wheat was not grown upon it. One part of the soil was a "blowing sand" and the other a flinty gravel; yet on these strata, aided by the skill, the capital, and the enterprize of the proprietor, the estate became fertile—the pride of the country! In 1816 Mr. Coke estimated the yield of wheat alone at forty to forty-eight bushels per acre. Such were the men who wrought that marvellous change of which Macauley speaks. "At the close of the seventeenth century," says the historian, "agriculture in Great Britain was in a rude and imperfect state. The arable and pasture lands were not supposed to amount to more than half the area of the kingdom. The remainder was believed to consist of moor, forest, and fen. In the course of little more than a century, a fourth part of England had been turned from a wild into a garden." After the introduction of drill husbandry, the total value of agricultural products in the United Kingdom has more than doubled. Fifty years ago, even, there was much land in Great Britain in the condition of some lands in our older States at present—either left in their wild state or exhausted of fertility. This has been entirely

changed. An hundred acres which, under the old system, produced annually, as food for cattle and manures, not more than forty tons, now produces 577 tons.

Prior to the commencement of the present century, there was but little agricultural progress in the United States. The first settlers had many and great difficulties to encounter in clearing the land, in bringing it under cultivation, and in defending themselves against the Indians. Besides, the French and revolutionary wars very much interfered with the peaceful pursuits of agriculture. Nor could the people, after the peace of 1783, burdened with debt, without money to pay their taxes, with no manufactures, and no foreign demand for breadstuffs, be expected to make much progress in tilling the soil. Washington was unquestionably one of the most enlightened and successful farmers of his day. His correspondence with Sir John Sinclair, and his constant supervision of his estate, even during the stormy period of the revolution, and amidst the pressing cares and anxieties of the presidency, afford conclusive evidence that he was first in the arts of *peace* as he was "first in war and first in the hearts of his countrymen."

But notwithstanding our early difficulties in planting an empire in the wilderness, our wars, our want of a market, our vast territory, sparse population, cheap land, and ruinous system of exhausting a virgin soil, yet great and manifold progress has been made in agriculture. The cast-iron plough, first patented in New Jersey in 1797, has undergone various modifications, until it has reached a high degree of perfection. The spade, the hoe, the hay fork, and the other common implements, tools, and vehicles of husbandry, are lighter, of better material and temper, and more adapted to the use of the farmer. A large number of our farmers now use mowers for cutting their grasses, and the vast wheat fields of the west and northwest could not be harvested without the use of the reaper, nor the wheat separated from the straw, and the corn from the cob, without threshing and shelling machines. So great is the demand for farm labor, so great the spirit of enterprise which urges our young men and adopted citizens to become freeholders, and so sure, so near, and so vast the market, that without mechanical appliances, and the use of horse and steam power in the cultivation of the soil, our vast fields of grain could not be harvested and made ready for food and shipment. At present the United States are somewhat behind England in substituting steam for human muscle; but many years cannot elapse ere steam will be made by our enterprising farmers to plough and plant, to dig, haul, and grind, and to pump, saw, and thresh, and thus allow them to devote more attention to those branches of agriculture requiring special study, time, and taste. In all portions of our country, but particularly in the older States, a great improvement is noticed in tillage. Lands are being extensively under-drained, deep and subsoil ploughing practiced, and great care and considerable skill exercised in the preparation and application of manures. In the use of improved agricultural implements a great change has everywhere taken place. It is common to see the best plough,

rollers, cultivators, reapers, threshers, fanners, hay and cotton presses, sugar mills, horse and steam powers, and a thousand other labor-saving machines, the results of skill and science.

This imperfect sketch of agricultural improvement in England and the United States is given in order to show that *progress* has not been the result of mere routine farming, but of *practically applied science*—of classified knowledge. The great channels, for the most part, through which this knowledge has been widely and authoritatively diffused, are agricultural societies and publications. Wherever they have been established, either in England, on the Continent, or in America, the spirit of inquiry and emulation is awakened, prejudices are removed, and the results of a wide and varied experience, both of individuals and associations, in every branch of agriculture, are classified and published for the benefit of every farmer.

Notwithstanding the relation which the mass of farmers in England and on the Continent hold to the soil, enjoying neither ownership nor hope of wealth, yet these societies and publications have awakened a genuine, wide-spread enthusiasm and desire for further information. They have been the means of rousing American farmers, especially, to the importance of artificial manures, to the necessity of under-drainage, to the most successful modes of culture, and to the best farm implements and machinery. It is an auspicious indication of the progress made in agriculture in our country that already a thousand associations exist in the various States, and that most of our farmers read one or more agricultural papers.

But, however encouraging these noble aids to intelligent and successful farming may be, yet the surest evidence of our progress is furnished by the Preliminary Report of the Census Bureau for 1860. The facts there published have been carefully collected, and the comparisons or results which they afford are exceedingly important.

The total value of agricultural implements manufactured in the United States for 1860, not including, of course, those made on the farm, was $17,802,514—being an advance of 160 per cent. on the amount manufactured in 1850. Among these implements are some of the highest importance to the farmer.

The threshing machine referred to before has been brought to a high degree of perfection, there having been issued, during the last fifty years, nearly three hundred patents for improvements. Being moved by horse or steam power, and furnished at a moderate cost, they are now in extensive use, greatly abridging the amount of manual labor, and enabling the wheat-growers to prepare their crops seasonably for the market.

In grain the census report gives the following results:

Wheat.—The quantity grown in 1859 was 171,183,381 bushels, being an advance, in ten years, of seventy per cent.; yet during the decade the ravages of the wheat midge in some of the older States have been very extensive. It is stated, however, that the midge is disappearing where, formerly, most de-

structive, and that wheat-growing will be resumed in many localities where, for a time, it was almost abandoned.

Indian corn.—The quantity grown in 1859 was 830,451,707 bushels, being an increase of over forty per cent. Drill planting, the horse-hoe, and improved corn-shellers, have greatly reduced the amount of manual labor necessary to the production of this crop, while the increased facilities for transportation to market have enhanced its value.

Dairy products.—The butter produced in 1859 was 460,509,854 pounds—an increase of forty-six per cent. The amount of cheese made, and the amount of milk and cream furnished to cities and towns, presents the same increase.

Cotton.—In the beginning of the present century the annual exportation was less than 5,000 bales; in 1859 production had increased to 5,198,077 bales. What is to be the future yield of this great staple time alone can reveal.

The value of animals slaughtered in 1859 was $212,871,653—an increase of nearly 100 per cent. We have no tables to show the increase of imported stock. There is evidence, however, that various improved breeds of cattle and sheep have been largely introduced into the United States during the last decade, and that better cattle and sheep of finer wool and heavier fleeces are now becoming common throughout the country. Sheep we have imported from France and Germany, and while the quality of the wool has been maintained we have increased the quantity.

When the census of 1860 is published in full the inexorable logic of its statistics will astonish the world, and prove to every intelligent mind that agriculture is the grand element of our progress in wealth, stability, and power. All the new States, during the early periods of their settlement, have rapidly advanced in population and agricultural wealth. This has, of course, been owing chiefly to the rapid influx of residents from the older States and Europe, and to the fact that large tracts of land have been rapidly brought under cultivation. Let Minnesota, during the last decade, be selected as a specimen of progress.

In 1850 the number of acres of ploughed land was 1,900; in 1860, 433,267. In 1850 the number of bushels of wheat raised was 1,401; in 1860, 5,001,432. This rapid agricultural development in ten years is not only an encouraging agency of future progress, but a most remarkable fact of American history.

Various other facts, which cannot now be stated in detail, strengthen the conclusion that American agriculture, especially during the last ten years, has made great progress. Farms throughout the country are more thoroughly cleared of stumps and stones, fences are neater and more durable, farm-houses are more conveniently and tastefully built and adorned, barns are constructed with more reference to the comfort of stock, to the housing of produce, and to the preparation and preservation of manures. A more ready access to markets is afforded by good roads, railways, and canals, improved implements are in general use, while a salubrious climate, a prolific soil, a broad and quiet land,

and a beneficent Providence have crowned with abundant success the labors of the husbandman.

Having reached this agricultural vantage ground by honest toil, guided by the lights of experience and science, it is an interesting question, to every American, What are the conditions of a still grander progress and prosperity?

The essential conditions, it seems to me, are—*peace; a continued and increasing demand for agricultural products, both at home and abroad; an increased respect for labor; a more thorough knowledge and practice of agriculture as an art and science;* and, finally, *a more thorough education of our farmers in the physical sciences, in political economy, in taste, and general reading.* Let us consider, briefly, these conditions. A state of war, whether civil or foreign, always reduces the productive industry of a country, and disturbs nearly all the great interests of society. Thus far, it is true, agriculture in the loyal States has been but little embarrassed by the march of armies and the devastations of battle; but this immunity cannot always be enjoyed should the war continue. We must return, therefore, to our normal condition, which is *peace,* if agriculture is to prosper

With all its wide-spread evils, the rebellion offers, nevertheless, some compensations, and these will plainly appear should the government finally triumph. In order to preserve the unity of our soil and nation, a noble patriotism has withdrawn, for the time being, a large number of citizens from the peaceful employments of agriculture. Some sleeping on blood-stained fields of glory, or beneath the sea, will never more return to the farms which they have tilled; others will come home with broken health, while the many with strong frames will remain, or return to the regions where the storm of war has passed, to make them again blossom as the rose, and to rear new homes for themselves and their children.

The transfer of labor is one of the results of war in every age. In our own case the gain will be considerable, as free labor, smaller homesteads, a greater variety of products, and higher skill and energy in agriculture will take the place of the old system. There must be for a time, in many portions of our country, a scarcity of labor. Men enough, however, for the ordinary requirements of agriculture will be found in every community until labor flows in from Europe, equalizing, somewhat, the demand and supply. Besides, the increased value and labor, and the great demand for breadstuffs at home and abroad, will bring more extensively into use the drill, the horse-hoe, the mower, reaper, thresher, and other labor-saving machines, driven either by steam or horse-power.

If our present unhappy war soon terminates, and the knowledge of our homestead law and increased demand for labor is disseminated throughout Europe, the tide of emigration must speedily set toward America with increased power. Without any special stimulant there has been, hitherto, a steady and large increase in this class of our population. In the decade ending 1840 the number of passengers of foreign birth who arrived in this country was 552,000; in that

ending 1850 the number was 2,707,624. The proportion of males to females for the three decades was as 60 to 39. Almost one-half of the whole number was between fifteen and thirty years of age. Of this total of 4,817,924 immigrants, 2,044,678—nearly all the males—were classed in the official returns as farmers, laborers, and mechanics. I believe this vast influx of labor will continue as heretofore, stimulated by the character of our institutions, the fertility and cheapness of our lands, the demand and remuneration of labor, the increased facilities for immigration, and the noble homestead law, which at once goes into effect. "Every acre of our fertile soil," says a great political economist, "is a mine which only waits the contact of labor to yield its treasures, and every acre is opened to that fruitful contact by the homestead act. When the opportunity, thus afforded to industry, shall be understood by the working millions of Europe, it cannot be doubted that great numbers will seek American homes in order to avail themselves of the great advantages tendered to their acceptance by American law. Every working man who comes betters the condition of the country as well as his own. He adds in many ways, seen and unseen, to its wealth, its intelligence, and its power." It is difficult to estimate the contribution which immigration, properly encouraged by legislation and administration, will make to the revenue, and therefore to the prosperity of the Union, under the guarantee and inspiration of this magnificent law.

The second condition, on which depends our agricultural progress, *is the continued and increased demand for our products, both at home and abroad.* If our country increases in population in the ratio of the last decade, 100,000,000 of inhabitants will be under American law in the year 1900. Besides supplying this rapidly-growing population, Europe and portions of South America will continue to be our customers. Some of the great southern staples, it is true, are temporarily withheld from Europe; but, unless the war continues long enough to create new fields of culture elsewhere, the demand will continue as of old. The statistics of our commerce, even in a time of war, prove that corn is king, and that it can always be made, as it is now, the great conservator of peace between England and the United States. The parliamentary returns of Great Britain for the calendar year 1861 exhibit the following important fact in regard to the amount, in bushels, of breadstuffs imported for that year:

Wheat and flour, 86,552,097 bushels; of which the United States furnished 38,361,675 bushels, or forty-four per cent.

Indian corn, 20,360,004 bushels; of which the United States furnished 11,705,034 bushels, or fifty-seven per cent.

Total, 106,912,101 bushels, or forty-eight per cent.

The New York trade tables show that the United States exported to Great Britain and the continent, for the year ending September 1, 1861, wheat, flour, and Indian corn, 42,524,816 bushels; for the year ending September 1, 1862, wheat, flour, and Indian corn, 52,112,225 bushels. Finally, the report of the British board of trade, for the ten months ending October 31, 1862, shows that

Great Britain received from the United States during that time produce amounting to $87,412,325, against $81,728,035 in 1861. This vast amount has been imported while all the southern ports have been blockaded, showing that we furnish, even in a time of war, about one-half of all the food imported into Great Britain, and that the amount is steadily increasing.

The third condition on which depends our agricultural progress is, *increased respect for labor.* In many portions of the United States this condition is amply fulfilled, and the healthful results are plainly seen in finely cultivated farms, in improved homes, in education, thrift, and all the pursuits of an honest, intelligent, and respected industry.

The two prominent causes which have tended to degrade labor in the United States are, first, *the many avenues to wealth, respectability, and position open to young men, independent of manual labor;* and, secondly, *the condition of a large portion of our laboring population.* A great point will be gained for agricultural purposes when farmers shall cherish not only a high respect for their employment themselves, but instil their convictions into the minds of their children. It is not only a great mistake but a great misfortune that young men should feel dissatisfied with the comparatively slow gains of agriculture, or that they should regard the farmer's life as one of tameness and drudgery. They notice the rapid growth of the property of the merchant, the trader, or the professional man, and see him in situations of apparent comfort and ease, limiting, however, their observations to the few who are successful, and not noticing the many who fail of ultimate success. Independent of the unrest, the disappointed ambition, the wear and tear, and mean rewards of public life, it is said that of one thousand merchants who had kept an account at one of the Boston banks, only *six died rich.* The number of successful merchants in New York is even less than this. On the other hand, the farmer, if not absolutely rich, is, at least, independent. He has a home which his labor and his taste have adorned; he has broad acres, not held by lease, as in many countries, but as a freehold. In the Old World land is generally divided into large estates, and owned by few proprietors. In England, for instance, the number of acres is 32,342,400; the number of proprietors about 44,000; in Scotland, 19,738,930 acres and 4,000 proprietors. Such is not the case in our country. No law of entail or primogeniture fosters the accumulation of large estates. It is one of the blessings of the American farmer that he owns in fee simple the land which he cultivates. He has not to stoop and cringe and stand in awe in the presence of those whom he calls masters. He has no master—no favors to beg of man. He has a sturdy independence of character, adorned, perhaps, by culture and refinement. He belongs to a class of citizens who hold in their hands five-sixths of the wealth of the country and its entire political power; and the hands which have wrought this wealth are able to defend the Constitution which makes us one people.

In speaking of the other influence which tends to degrade labor in the United States I do not propose to discuss the vexed question of the relation between

capital and labor, but to state a fact as patent as any other on the surface of American society. Slavery always and everywhere degrades labor. This degradation is positive at the south, while its reflex influence is felt throughout the north, in spite of the teaching of the press, the pulpit, the platform, and the example of millions of honest, noble, hard-working men. Had labor been respected at the south—had the soil, divided into moderate farms, been owned by those who tilled it, as at the west—no rebellion would have been desirable or possible. In Brazil the same influences are at work as in our own country. Servile labor has so degraded agricultural industry that a plough was unknown there thirty years ago, and an empire capable of feeding all Europe has never been able to raise food sufficient for its own 7,000,000 of inhabitants, but depends for its breadstuffs upon the United States and the neighboring republics. Though the greatest inducements have been held out by the government, immigrants, owing to the condition of labor, have hitherto been slow in settling in Brazil. Those who have gone, however, are forcing, by superior skill, intelligence, and public sentiment, slave labor towards the equator, and winning the victory which free labor ever gains.

Labor, for a fair remuneration, whether of the brain or hand, should be the glory of America; besides, there is true dignity in labor, especially in cultivating the soil. The object which the farmer has in view is to subdue the earth; to eradicate its briars and thorns, and to plant in their stead what is useful and beautiful to man. It is to fulfil the original appointment of the Creator, that man "shall eat bread in the sweat of his face." "Labor," says a noble worker, "has been made by Providence the law of man's condition. It is the price at which whatever is valuable in life must be earned. Whatever, therefore, degrades labor as the business of life, or renders it distasteful or dishonorable, does violence to our social laws no less than to a wise economy." All improvement—all progress of the race in civilization—has been the result of intelligent labor. It has built our cities, dug our canals, constructed our railways, developed our mines, built our steamers and ships, given life and energy to the industrial arts, and, above all, is feeding and clothing our people and providing for their happiness. "The nation," says Dr. Sam. Johnson, "that can furnish food and raiment, those universal commodities, may have her ships welcomed at a thousand ports, or sit at home and receive the tribute of foreign countries, enjoy their arts, or treasure up their gold." Let labor, therefore, be crowned with honor—that labor, especially, which contributes so much to the welfare of man, and allows him to approach nearest, through Nature, to Nature's God.

The fourth condition on which depends our agricultural progress is *a more thorough knowledge and practice of agriculture as a science and as an art;* and by this is meant a knowledge of the principles—the *whys* and the *wherefores*—which lie at the foundation of successful farming, and of the practical application of those principles, combining skill, economy, and all the appliances of art. The great difficulty with the American farmer has been, and still is, that he

has been nurtured and educated in the habit of cultivating a *primitive soil.* The labor and expense attending the accumulation and application of manures, with the necessity of *unlearning* old habits and theories, have made him tempt nature to the verge of exhaustion, and degrade a noble profession to one of mere routine. While Americans are ever disposed to boast of their inventive skill and teachable disposition, the elder nations, which we affect to despise, offer us some valuable lessons in agriculture. The Chinese, by minute and careful culture, by rotation of crops, and by the use of *every possible kind* of manure, have made their lands yield undiminished products for thousands of years. The northern provinces of China produce two annual crops, and towards the south five are usually obtained every two years. This prodigious yield has continued for ages, and yet the soil is rich and productive, teeming with nearly four hundred millions of human beings. The spade is extensively used; every inch of ground is thoroughly tilled; the hills are terraced, and the soil irrigated wherever possible. Agriculture is everywhere honored and encouraged. The Emperor himself goes annually to the field and turns the first vernal furrow. If China or Japan were to follow our methods of tillage, famine and death would soon sweep millions into their graves.

There is still in our country, strange to say, a large amount of what may be styled *routine* farming. The soil is tilled, the same seed sown, and the crops succeed each other year after year. In some cases, when the soil is inexhaustible, this may be the best method of farming for the present owners; besides, the example of father to son is invaluable, provided that example be good. Practical knowledge is certainly superior to mere theory; but to persist in the same succession of crops, in replanting the same and often the poorest seed, in pursuing the same methods of culture, in rearing the same common breeds of stock, in using the same poor implements of husbandry, is to deny the value of the aggregate experience of men of similar pursuits, and to ignore the progress of the age in science and the useful arts. It should be the aim of every young farmer to do not only as *well* as his father, but to do his best; "to make two blades of grass grow where but one grew before."

"Agriculture," says an ingenious writer, "is an art—man the artist. The soil is his laboratory; manures and seeds his raw material; animal strength and machinery his power; air, heat, and moisture his agents; and grain, roots, fruits, and forage his products. Agriculture is also a science, teaching the artist the best modes of improving and fitting up his laboratory; instructing him in the properties and economical use of his raw material; teaching him how best to apply his power and profit by his agents, thereby enabling him greatly to abridge his labors and multiply his products." Art teaches the hand to do—science, *what* and *how* to do. Art belongs to the individual—science is the concentrated experience of ages and the labor of nations. It is, in short, classified knowledge illustrated in practice and confirmed by experience, and as certain and eternal as truth itself.

The great object of agriculture, as a result, is to develop from the soil as

large a quantity and as excellent a quality of useful vegetable, or, indirectly, of animal, products as possible. In order to do this, the farmer should aim to preserve and increase the fertility of the soil; to free it from moisture when superfluous, or add to it when insufficient; to cultivate it thoroughly by the most approved methods, sowing the best seeds according to soils, climate, localities, and markets; to economize labor and expense by using the best implements and power; to select the finest breeds of animals, feeding and sheltering them in the most judicious manner; to secure most perfectly the several harvests, and prepare all farm products for the market in the best manner.

In order to make the farmer most successful, and thus to advance agriculture, the great interest of the republic, he should study chemistry as applied to soils, plants, grains, animals, manures, climates, localities, and tillage. This science, applied to agriculture, teaches him that of the sixty-four simple substances some thirteen go to form vegetation. It cannot be said that any one of these elements is more important, absolutely, than another, except that some of them are scarcer in some soils than in others, and more difficult to procure, and therefore, agriculturally, more valuable. Chemistry, by its powers of analysis, reveals the nature and composition of soils; teaches the proper kind, value, and application of manures; the mode and means of nutrition; and the knowledge of supplying wants and of correcting deficiences and excesses, wherever noticed, in cultivation. Agriculture is a growth, like the plant it cultivates; and like the mind, also, the more it is developed the more it yields. It can be easily shown that there is no occupation of life where extensive knowledge is more necessary than in the proper cultivation of the soil. There is no occupation so intimately blended with all the branches of the natural sciences; to which geology, chemistry, botany, and entomology are such valuable auxiliaries. Of all human pursuits agriculture is first in order, in necessity, and importance. The best farmer is always the most intelligent man, and a community of knowledge is one of the strongest ties that can bind and bless society. The simple argument, therefore, is this: increased scientific and practical knowledge in any occupation increases man's power in a tenfold ratio; agricultural knowledge, therefore, begets *productiveness*, and in the same proportion develops the wealth, the prosperity, and the progress of our country. Sir Humphrey Davy once remarked, when speaking of the future influence of agricultural chemistry, that "nothing is impossible to labor aided by science. The objects of the skilful agriculturist are like those of the thoughtful patriot. Men value most what they have gained with effort, and a just confidence in their own powers results from success. They love their country better, because they have seen it improved by their own talents and industry, and they identify with their own interests the existence of those institutions and pursuits which have afforded them security, independence, and the multiplied enjoyments of civilized life." How strongly do these noble words from the father of agricultural chemistry appeal to the judgment and pride of every farmer to excel in his calling!

Another essential condition to agricultural progress, and following naturally the last named, *is a more thorough education of the farmer in physical science, in political economy, in taste, and general reading.* In fulfilling the condition of a thorough agricultural knowledge, the farmer will have advanced considerably towards an honorable education, and the greatest efficiency and success in his special calling. Still, there is a certain general culture which should characterize every intelligent citizen of a free country, fitting him to think and act wisely and well in all the relations of life. As our government, laws, institutions, and administration spring from the people, and as nine-tenths of our people are tillers of the soil, how important that, as a class, they should have broad and just views of whatever affects the common weal! Though far away from the great centres of political and commercial influence, yet they have the power to make all public servants respect and study their interests, which are eminently those of the whole country. Every farmer, therefore, should aim to be instructed, not only in his special calling, but to know something of general science, of political economy, of taste, and current and general reading.

First, then, in regard to those sciences which are the handmaids of agriculture—what a field of study! These are meteorology and electricity, explaining atmospheric phenomena, upon the changes of which nearly all the operations of farming depend; hydraulics, suggesting plans for the recovery of swamps and submerged lands; botany and vegetable physiology, teaching the relations between natural plants and their soils, in order to establish artificial soils and the highest cultivation; exhibiting, also, the structure of the different orders of cultivated plants, and explaining their nature, and the use of the healthy, and the injurious effects of diseased secretions of plants; geology, explaining the formation of the earth's crust in reference to drainage, and the effects of subsoils on the growth of trees and plants; mechanics, teaching the principles of machinery; anatomy and animal physiology, explaining the structure and functions of animal economy, with a view to perfect development and the prevention of disease; and many other cognate branches, a knowledge of which tends to make man the master of nature. The farmer should also be educated in political economy and those kindred studies which aim to make him a thoughtful and intelligent citizen. Being the vast majority in numbers and wealth, and sustaining the wheels of finance, of trade, manufactures, and commerce, the agriculturist has too much at stake to be behind any in education and influence. Finally, the farmer should breathe that general atmosphere of thought, which, coming to us from distant ages and across the sea, is fanned by pulpit, press, and printed book. Our fathers endured many hardships and privations; but the young farmer of to-day possesses a wealth of advantages for general culture enjoyed by no other people. In some portions of our country these advantages are being improved, and the yield of cultivated mind, like that of the earth, is, indeed, wonderful; but as there is no royal road to agriculture, neither is there to knowledge. The latter must be acquired by long mental husbandry, but, like that of the soil, it yields many solid pleasures

during the period of hardest toil, while old age is full of health, wealth, ripeness, and joy, like the rich harvest of autumn. There are, really, but two great sources of national weath—the *soil* and the *mind* of a nation. Where do we find the most prosperous individuals, communities, and nations? Where the mind and the soil are most cultivated. If, then, the cultivation of these adds wealth, power, and prosperity to a nation, the lack of either, where it might abound, is so much waste of national capital. Why is it, let me ask, that the annual earnings and products of Massachusetts—a State unfavored in soil and climate—exceed, *per capita*, not only those of every other State in our Union, but of the world? Why is it that the labor of a single man in Massachusetts is equal, in profit, as has been conclusively shown by the census, to the labor of five men in South Carolina? It is because her people believe, most thoroughly, that "knowledge is power," and that it is the highest wisdom of political economy to invest largely in schools, colleges, books, a free press, and the highest culture of the individual, to the end that labor may be more productive because more skilled and better directed. But this culture of the mind in science, taste, and general reading, should be based on a higher consideration than that of mere moneyed profit. It should be sought for its own sake, and the pleasures which it brings. The farmer should have taste to appreciate and enjoy the beautiful in nature and in art; taste to adorn his home and his lawns with shrubbery, flowers, and works of art; taste to admire the ripening fruits, the glowing landscape, the processes of nature, and the living groups of animals which he has reared—more attractive to the eye than any painting, though drawn by the genius of Landseer.

Let the farmer, therefore, as a cultivated man, magnify his occupation. In all ages wise, learned, and good men have gladly turned away from the employments of public life to the pleasures, the consolations, and the quietude of rural pursuits. Without citing the men of other countries and ages, who can forget how eagerly Washington laid aside his robes of office and sought the repose of Mount Vernon; how gladly Clay returned to the shades of Ashland after the excitement and honors of congressional life; and how Webster hastened from the cares of state to his herds and fields, and the sight and sounds of the ocean, all endeared to him by the sweet memories of rural life? Men who have chosen to follow other avocations of life, and who pursue them with success, still long for the pleasures and employments of the farm. All their plans of life have a kind of natural culmination in the determination to retire into the country and share with the farmer the healthful and dignified occupation of husbandry.

I have dwelt thus at length on the history of agriculture, and on the conditions of agricultural progress in the United States, in order to show that a great national department of agriculture, enjoying the sympathy and co-operation of the government, of agricultural societies and publications, and of individual farmers, will most rapidly and certainly develop and strengthen these conditions, and thus augment the wealth, the prosperity, the permanency, and

the glory of the republic. I hardly deem it necessary to attempt to convince our intelligent countrymen of the vast importance of such a department, inasmuch as whatever improves the condition and the character of the farmer feeds the life-springs of national character, wealth, and power. What agricultural societies and publications have done for single counties and States, this department should do for the whole country, but with a liberality, wisdom, and catholicity commensurate with the resources of the nation, the importance of agriculture, and the co-operation of individuals both at home and abroad.

The objects of a great national department of agriculture were well stated by Judge Buell over twenty years ago, and they are chiefly these:

1. Collecting, arranging, publishing, and disseminating, for the benefit of the nation, statistical and other useful information in regard to agriculture in its widest acceptation, embracing, not only the usual cultivation of the soil, but orcharding, plain and ornamental gardening, rural embellishment, the veterinary art, and household economy. In this connexion the department should aim to teach or recommend authoritatively, by concentrating the ripest agricultural experience and scholarship, the best methods of culture, the choicest plants, vegetables, and fruits, the most valuable grains, grasses, and animals, domestic and otherwise, and the most improved implements of husbandry.

2. Collecting, from different parts of our own and foreign lands, such valuable animals, cereals, seeds, plants, slips, and cuttings as may be obtained by exchange, purchase, or gift, with information as to their modes of propagation, culture, preservation, and preparation for market, and distributing the same throughout the country. Through our postal franking privilege at home, and our foreign ministers, consuls, merchants, missionaries, travellers, and the officers of our naval and merchant fleet, the government enjoys unusual facilities for carrying out this object.

3. Answering the inquiries of farmers and others on all matters relating to agriculture, at the same time stimulating inquiry, inviting discussion, and rewarding research by publishing agricultural statistics of the various States and sections of States in order to guard against the excess or diminution of given products, thereby saving much time, labor, and capital to farmers. And as this department has been created and is sustained for their benefit, they are earnestly invited to correspond with it in order that a proper selection of subjects may be afforded for publication.

4. Testing, by experiment, the value of different agricultural implements and their adaptation to the purposes intended, as well as testing the value of cereals, seeds, and plants, and their adaptation to our soil and climate, before transmitting them to our farmers. In order to carry out this object the department should have under its control a model farm.

5. Analysis, by means of a chemical laboratory, of various soils, grains, fruits, plants, vegetables, and manures, and publishing the results for the guidance and benefit of agriculturists.

6. Establishing a professorship of botany and entomology. It is well known

that insects are annually destroying a vast amount of the products of our soil, and that their ravages appear to be on the increase. If the damage done to our wheat crop alone could be prevented, millions of money would be saved to the country.

7. Establishing an agricultural library and museum. In this library the most valuable works would gradually accumulate by exchange, gift, and purchase, forming a rich mine of knowledge. The museum would embrace models of all the most approved implements of husbandry; specimens of soils, rocks, &c.; samples of the various productions of the garden, field, and forest; varieties of grain in straw, and in sample, now generally cultivated or recently introduced into the country, with explanations respecting their soils, climates, weight, yield per acre, and their value as food. Here should be arranged specimens of the component parts of soils, manures, and all the products of agriculture, showing especially the values of different kinds of food. On the walls of this museum should hang the portraits of animals of the most celebrated breeds, and under its roof should be gathered whatever would tend to attract and instruct persons of the highest taste and education.

In regard to the actual condition, workings, and plans of the department, as at present constituted, a few remarks are submitted.

The Department of Agriculture entered into operation on the 1st of July, 1862. The sum expended under its direction, for all purposes, to the 1st of January, 1863, amounts to $34,342 27, leaving an unexpended balance of the appropriation (act of March 1, 1862, chapter 34) for agricultural purposes, for the fiscal year ending June 30, 1863, of $25,657 73. I have asked Congress for an appropriation of $130,000 to meet the expenses of this department for the fiscal year ending June 30, 1864, which is deemed a low estimate. That amount has been approved of and passed by the House of Representatives with almost unanimous consent, and I cannot but believe that it will meet with the concurrence of the Senate of the United States.

Up to January 1, 1863, there have been distributed to members of Congress and other persons throughout the Union 306,304 packages of seeds and cereals, and a much larger number will be sent out between this and the 1st of April next. A large quantity of cotton and choice tobacco seeds, not included in the above enumeration, besides cuttings, bulbs, and plants, have been widely distributed.

A vast amount of labor has been performed in the department since its organization, and its business operations have increased and are daily increasing beyond my most sanguine expectations. Information from every available source, both at home and abroad, has been laboriously sought for, and is now being obtained, which, in due time, when properly classified, will be disseminated, like the seeds, cereals, and plants, gratuitously. The mighty and growing west, especially, has been foremost in this generous rivalry of agricultural exchange, both of products and knowledge.

While the farmer and planter are thus encouraged in their experiments, this

department becomes a means of communication with the governments and peoples of all lands. It aims to provide samples of whatever American seeds, plants, &c., may be best suited to foreign climates and soils. It strengthens our friendly relations abroad and at the same time uses its official power and influence to obtain whatever may advance the agricultural interests of our own country.

The third section of the act referred to above, stipulates that the Commissioner of Agriculture "shall receive and have charge of all property of the agricultural division of the Patent Office in the Department of the Interior, including the fixtures and property of the propagating garden, &c." I regret to have to state that, up to this time, no official transfer in compliance with said act has been made to this department; nor has any official report or statement been submitted to me, (although the attention of the Secretary of the Interior was called to the subject early in July last,) setting forth the true condition of the affairs of the said Agricultural Division on the 30th of June, 1862. Fortunately the chemist to the department was in possession of an extensive scientific library and apparatus which he kindly placed at my disposal at the commencement of my duties as Commissioner. The season had so far advanced, however, that but few tests could be made. The chemist has, nevertheless, analyzed some twenty-two varieties of grapes, and is at present engaged in the examination of ten or twelve varieties of American wine; also sorghum, from eight or ten different localities, in order to determine the relative value of the sirup and its capabilities for producing sugar and molasses when compared with sugar cane. The department expects samples of the sorghum from all the States where it is grown, and also from the different sections of each, with samples of the soils from which each specimen of sorghum was produced, in order to determine what composition of soil will produce the best sugar or the largest quantity of sirup. The simple facts in regard to the introduction of the sorghum into the United States afford the strongest argument in favor of testing the value of other foreign products. This plant was first introduced in 1835, through the agency of the Agricultural Bureau of the Patent Office. The yield of sirup, in 1862, in the western States has exceeded 40,000,000 of gallons, an amount in cash value more than sufficient to compensate the government an hundred fold for every dollar ever expended in this bureau. Another interesting fact in regard to the sorghum is, that from its fibre two mills in Illinois are already manufacturing a good article of paper.

As soon as arrangements now being made in the laboratory are completed, the chemist will enter into the analysis of the various grasses and grains of the United States, in order to learn which will produce the greatest amount of fat, flesh, muscle and bone; also of soils, manures, and the constituents of plants, with special reference to restoring fertility to exhausted farms.

The culture of cotton has lately attracted much attention in the free States—especially in Illinois—owing to the rebellion and the consequent scarcity of the staple. Last summer, as a matter of experiment, 500 to 1,000 pounds of cotton

were raised per acre by many farmers of Illinois. This department will take early and active measures to induce farmers in Kentucky, Missouri, Southern Illinois, Indiana, and Kansas—all of which States will undoubtedly produce cotton—to turn their attention to the culture of this important staple.

Special interest is felt by the department in the propagation and culture of the ailanthus silk worm of China. This insect has been successfully bred in this country during the last season. It will live and grow and spin its silk in the open air in most of the States of the Union, feeding upon the leaves of the ailanthus, hitherto regarded among us as a worthless, if not a noxious, tree. The worm has recently been introduced into France, and has excited an extraordinary interest. The silk of this worm lasts twice as long as that of the mulberry worm, and can be washed like linen. Indeed, in China the garments made from it are often worn by the second generation.

The attention of the department has been particularly directed, by an act of Congress, to the mode of preparing flax and hemp as a substitute for cotton. Persons engaged in experimenting on these fibres feel sanguine of success. The department has already been put in possession of some fine specimens of the flax-cotton, as well as several samples of fabrics woven from the thread of that material. The investigation will be continued.

The introduction and naturalization of the alpacca should also receive the attention of the government. Although found under the equator, it lives and thrives in the highest inhabited districts of the Andes, where the cold is more severe than in most parts of our country. The animal is hardy, and can subsist on the coarsest and scantiest food, where common sheep would die. While its flesh is excellent, its fleeces are fine, and used for many purposes, to which our Saxon or merino wools, owing to the shortness of their staple, and the difficulty of making them perfectly white, are inapplicable. The British government has expended large sums of money in introducing, (and successfully,) the alpacca to Australia, and our government should follow at once the same wise policy.

The *paparer somniferum,* or true opium poppy, can, no doubt, be successfully and profitably cultivated in some parts of the United States. It is notorious that no drug is so generally adulterated as opium when received from abroad. As in the case of wines, a native cultivation would supply a pure article, and certainly such a result would be desirable, when the object is a medicinal agent so important and invaluable.

The Department of Agriculture cannot, of course, carry out the general or particular objects indicated in this report, unless it receives, in a liberal measure, the aid of the government and the co-operation of the friends of progressive agriculture. Without entering upon an elaborate discussion, let the vast interest which the department proposes to foster and develop be the high argument in its favor. However much I have shown, indirectly, from history and statistics, the importance of agriculture, I now urge it, directly, as the great element of national unity and prosperity.

Agricultural pursuits tend to moderate and tranquillize the false ambition of nations, to heal sectional animosities, and afford a noble arena for honorable rivalry. The acquisition of comparatively slow, but sure, wealth, drawn from and reinvested in the soil, develops health of body, independence and simplicity of life, and love of country; while the rapid accumulation of wealth, not by production, but by trade and speculation, is unnatural and unhealthful. It attracts men to cities and tempts to wild investments. It too often unsettles moral principle, and substitutes selfishness for patriotism. Men of the country, living in calm content, and forming almost the entire wealth and population of the Union, constitute the truly conservative element in our politics. The men of the city, living in the midst of excitements, political, social, monetary, and moral, too often feed those baneful causes of national ruin, to wit: speculation, luxury, effeminacy, political corruption, and personal ambition. Never was truer or more comprehensive line of poetry penned than that which declares that

"God made the country—man made the town."

Next after moral and intellectual forces, home and foreign commerce, manufactures, lines of intercommunication and agriculture, form the great arch of our national prosperity—agriculture being the keystone as well as the foundation of all. Agriculture furnishes the food of the nation, the raw materials of manufactures, and the cargoes of domestic and foreign commerce. It is the cause and the evidence of true civilization; for, when tillage begins barbarism ends, and the various arts commence. When agriculture prospers, all other interests prosper. When this fails, depression, panic, ruin, ensue. The surplus of agriculture not only allows the farmer to pay his debts and accumulate wealth, but also does the same for the nation. To increase this surplus, therefore, to develop and bring out the vast resources of our soil, and thus create new additional capital, should be the great object of the Department of Agriculture and of legislation. Wise governments, with limited, available territory, so shape their political economy as to reap the advantages of agricultural nations. Thus the United States, agriculturally, form a part of England's prosperity. It has come to pass that her capitalists, her operatives, and her poor, are in nearer sympathy with, and more dependent upon, our broad acres than are our own people. Food, therefore, and next raiment, is the great central interest, around which all other interests revolve. "Grain," says Adam Smith, "is the regulating commodity by which all other commodities are finally measured and determined;" and on this account grain-growing nations will ever command the precious metals and the respect, if not the fear, of mankind.

The United States are, and must always remain, an agricultural nation. For this the soil, the climate, the institutions of the country, and the age of the world, have peculiarly fitted them, and it is the duty of the government to take all possible measures to secure to the agriculturists of America the fullest benefits of its ample resources.

It is hard to realize, and yet as true as Holy Writ, that some who shall read,

to-day, these lines, will live to see one hundred millions of freemen dwelling in this dear land of ours. With peace and union restored, based on equity and freedom; with all the conditions of agricultural and mental progress fulfilled; with iron bands stretching from the pines of Maine to the Golden Gate; with the hum of factories on ten thousand streams, and swift-winged commerce flying to distant lands, what pen can sketch the possibility of this young giant of the west?

Old Rome, with all her elements of decay constantly at work, lasted nearly one thousand years, and carried her culture, civilization, and arms to a wondrous pitch of glory. May we not hope and devoutly pray that, taking warning from history and the signs of the times, our republic may so learn lessons of wisdom, that, eradicating all destructive tendencies, she will fortify herself against decay, and become, what Rome was not—eternal?

ISAAC NEWTON,
Commissioner of Agriculture.

His Excellency ABRAHAM LINCOLN,
President of the United States of America.

THE INTERNATIONAL EXHIBITION OF 1862.

BY PROF. J. W. HOYT, COMMISSIONER FOR WISCONSIN.

The progress of the world in civilization has not been gradual and uniform, like the ascent of an inclined plane, but spasmodic, saltatory, like the climbing of steep and difficult stairs. An age, perhaps ages, with scarcely any perceptible progress, then a sudden leap upward: this is the record of history, and it is probably the law of human development. Religion, science, the industrial arts, afford illustrations of this law.

It was logical and necessary that the triumphs of industry should come last, because the arts depend upon the applications of science for their development, and could not, therefore, precede it. May we not congratulate ourselves that the grandest era in their progress has come in our day, and that the method of its coming is not only an earnest of that better day when man shall have gained a complete mastery over the elements and forces of nature, but also a sure prophecy of the final brotherhood of the nations?

For centuries man, in his rude simplicity, had been struggling with the subtle forces of the universe, scarcely dreaming that he was destined to subdue them for his own higher uses. But, after ages of stumbling and serving, the Genius of Science came, and to-day he is clothed with a power of which even the gods of mythology could have had no conception! Yet, not immediately; for it was only after a century of heroic effort on the part of the world—studying, experimenting, discovering, applying, and concealing—that a better light dawned, and artists and artisans said, "Let us of the same neighborhood or nation compare notes, and so, by helping each other, more rapidly advance the civilization of our own country, even to the outstripping of all other peoples." Thus it was in France, England, Belgium, Germany, Italy, Russia, and America, throughout the first half of the present century, until, at last, there came a man of larger views and wider philanthropy, who said to his countrymen, then preparing for a great gathering of the products of the industry and art of the mightiest kingdom of the earth, "Let us not narrowly restrict our efforts for the advancement of the civilizing arts and sciences to the boundaries of our own realm, but rather, as inspired by a broad and universal philanthropy, make this exhibition a grand gathering of the products of all the nations, upon terms of equal advantage, and so rapidly help to accomplish that great end—to which, indeed, all history points—the realization of the unity of mankind!" Such were the sublime aspirations, such the noble language, of him who justly merits therefor the title of the great seer of the world's industrial progress.

It was this idea, so forcibly expressed by his royal highness the late Prince Albert, that gave origin to the first World's Exhibition, held in the first great Crystal Palace, at London, in the memorable year 1851, and thus marked a new era in the progress of the world's civilization.

Of that first great exhibition—so sublime in its conception, so magnificent in its execution, and so glorious in its results—it is not my province to speak in this brief paper, unless, by way of comparison, to say, It was simply a fit and worthy forerunner of the Exhibition of 1862, and the inauguration of a

grand series, the influence of which upon the world is beyond the power of human calculation. Concerning those subsequently held, in 1852 and in 1855, at New York and Paris, respectively, I may venture the assertion that, though partially successful, and, without doubt, productive of good, they were, nevertheless, inopportune, and neither of them equal to the full measure of a world's exhibition. Once in a decade is, probably, as often as all the nations of the earth will deem it economical or necessary to meet and compare results.

PREPARATIONS FOR THE EXHIBITION OF 1862.

The Crystal Palace, in which the Exhibition of 1851 was held, having been removed to Sydenham, it became necessary to erect a new building for 1862. The success of the first enterprise gave assurance that the second could not be a failure, and that accommodations yet more remarkable in extent would be necessary. The requisite subscription was promptly raised, and the building erected on Cromwell, Prince Albert's, and Exhibition roads, immediately south of Kensington Gardens, and but a short distance from the site of the Great Palace of 1851. The plan was designed by Captain Fouke, R. E., and though in no respect equal in external appearance to its wonderful, world-famed predecessor, it was, nevertheless, well adapted to the purposes intended, giving, in the end, very general satisfaction. Its area, including picture galleries and "annexes," is twenty-four and a half acres. The main portion of the building, or that which was constructed and finished in uniform style, and supplied with galleries, is rectangular in form, measuring 1,200 by 700 feet, with a tower at each of the four corners and in the centre of the south side, and with two immense domes—one at the centre of the east, and the other at the centre of the west, end of the palace. The walls on the east, south, and west are of brick; the north side, fronting the gardens of the Royal Horticultural Society, is of glass; the domes are also of glass, 250 feet high and 160 feet in diameter; the roof, which, except over the galleries, is self-supporting, is mostly of glass, and lets in a flood of light, favorable for the most satisfactory examination of the minutest articles on exhibition.

The interior division of this part is into a grand nave 85 feet wide and 100 feet high, connecting the domes, and dividing the building longitudinally into two equal parts; two transepts, of like width and height, crossing the two ends of the building at right angles to the nave, and with one of the grand domes over the centre of each; into open courts, with glass roofs 100 feet high; a series of long apartments, some 60 feet wide, on the south side, and a series of refreshment rooms on the opposite or garden side; all the remaining space on the ground floor being covered with galleries supported by handsome bronzed pillars. The style of the interior architecture is light and graceful; the decorations tasteful and highly pleasing.

In addition to this main portion, which is so well arranged and so durably constructed that it may serve a like purpose for years to come, there were two "annexes," reaching out northward from the northeast and northwest towers. One of these, 975 feet in length and 200 feet in width, was intended for operative machinery; the other, 800 feet long and 200 feet wide, on Exhibition road, was devoted to the products of the mines of Great Britain, machinery at rest, agricultural implements, &c. The extremities of these two "annexes" were connected by curved façades with the magnificent crystal conservatory of the Royal Horticultural Society, whose beautiful gardens, made attractive by inimitable lawns, parterres, statues, and fountains, were thus completely enclosed.

THE OPENING OF THE EXHIBITION,

on the 1st day of May, was an occasion which must ever be fresh in the memory of the happy, thronging multitudes who witnessed it. The long months of patient, skilful labor on the part of commissioners, architect, and contractors,

had been completed; the widely distant crystal domes of the mighty palace stood perfected in their unequalled magnificence; proud ships, freighted with cargoes diverse and wonderful, from every land on all the continents, and from many strange and distant isles, had come over the seas; the representatives of all peoples and kindreds and tongues were gathered together at the world's great metropolis to witness the grand spectacle; while the inhabitants of the whole earth waited for the hour that they might in full accord rejoice over the new triumphs of the industry of man!

The day was worthy the occasion, and the grand ceremonial as imposing as it could have been without the presence of her Majesty the Queen and the much-lamented Prince Consort, in whose broad and generous views the idea originated, and to whose sound judgment and indomitable energy the success of the first, and of this industrial exhibition, is so largely due. It had been the purpose of the Queen to officiate personally, as before, in the ceremonial of the opening; but this having been rendered impossible by the dispensation of an inscrutable Providence, it was her pleasure to appoint his royal highness the Duke of Cambridge, his grace the Archbishop of Canterbury, the lord high chancellor, the Earl of Derby, the lord chamberlain, Viscount Palmerston, and the speaker of the House of Commons, to be her representatives to conduct it in her name. A grand procession, composed of royal personages, official dignitaries, and representatives; appropriate addresses; music specially composed for the occasion by Meyerbeer, Sterndale Bennett, and other masters, and grandly executed by an orchestra consisting of two thousand selected vocalists and four hundred instrumental performers; a prayer by the Bishop of London; the national anthem by the multiplied thousands within this new, grand cathedral, dedicated to the Industrial Progress of Man, and the Great Exhibition was open!

THE EXHIBITION, GEOGRAPHICALLY CONSIDERED,

leads us to glance, in the next place, at the relative position of the national industries, the extent of space occupied by each, the general nature and relative character of their products, respectively.

We have entered from Exhibition road, and now stand directly under the great eastern dome, our faces looking down the nave towards the western dome, distant nearly a quarter of a mile. Ten thousand objects bewilder the eye with their variety and magnificence. The hum and clatter of machinery, the ringing of bells, the pealing of grand organs, the trampling of myriads of restless feet, and the music of eighty thousand human voices, at once amaze and delight the ear; while high above us, upon the arched and self-supporting girders of the nave and transepts, emblazoned names of all nations, made more effective by the gaily flaunted banners, representative of a vast number of nations, colonies, and municipalities, which decorate the galleries on every side, assure us that here the people of every zone and of every clime have brought the products of their industry and genius and spread them before the world, each for the inspection of all! It is a grand spectacle, such as was never before witnessed, and it is not strange that for a time neither the eye nor the mind will rest upon any individual object.

It will be observed that just half-way down the nave, and crossing it at right angles, is a broad avenue, leading from the great central entrance on Cromwell road, directly across the centre of the building, into the gardens, and leaving upon the ground floor alone, of the eastern half wherein we stand, a space whose area—including the eastern annex, which, as we still look westward down the nave, stretches away to our right—is not less than 18,000 square rods. Well, with the exception of the little American corner under the tower at our extreme left, and another small space devoted to China, Japan, and West Africa in advance and to the right of us, next the entrance to the gardens, all

this vast area, together with the galleries above it, is exclusively occupied by the products of the United Kingdom and her colonial possessions.

We will glance at the principal divisions of this great department. All the articles embraced within the Exhibition are divided into the following sections and classes:

Division I. Raw materials, including classes I to IV.

Division II. Machines, implements, &c., including classes V to XVII.

Division III. Textile, felted and laid manufactures, including classes XVIII to XXX.

Division IV. Metallic, vitreous, and ceramic manufactures, including classes XXXI to XXXVI.

Division V. Works of art, including classes XXXVII to XL.

Great Britain is splendidly represented in all these classes. Here, beneath the dome, is the great gilded pyramid, six feet by six at the base and forty feet high, which represents the bulk of solid gold derived from Victoria since the exhibition in 1851. Before us, along the centre of the nave, and in the courts prominently fronting thereon, statues, obelisks, light-houses, telescopes, collections of beautiful porcelain, splendid furniture, trophies of guns, leather, woollen fabrics, and food, together with magnificent cases of gold and silver plate and precious jewels. On our left, along the transept, we behold matchless metallic screens, splendid displays of London hardware, steel, chimes of steel bells, with Gothic brasswork, gas-fittings, mediæval hardware, lamps, and grates of superior style, terra-cotta work, enamelled slates, and marble mantels, and other objects exhibited for architectural beauty, at the side; while over all, and at the very extremity, stands the great cathedral organ, whose solemn notes peal out in sublime music through all the grand aisles of this temple of industry.

On the right, stretching away to the other extremity of this same transept, and under the gallery next the wall of the palace, we have first another great organ, then the fine timber trophies of Tasmania, New Brunswick, and Canada, ninety feet high; a shaft of coal from Nova Scotia, thirty feet in height; a trophy of natural objects from Vancouver's island, and most interesting and extensive collections of products from other of Britain's numerous colonies; mineralogical specimens, agricultural products, and simple manufactures from Prince Edward's island; agricultural implements, grains, skins, minerals, &c., from Canada; seeds, spices, silver filigree work, and beautiful lace from Malta; woods, spices, fibres and their manufactures, from Ceylon; and rum and other spirits from Jamaica, Barbadoes, and Bermuda.

The eastern annex, which is continuous of this transept, extending in the same direction, likewise belongs to the British department. In it are found, 1. Products of the mines and quarries, together with articles manufactured therefrom; coals, marbles, serpentines, granites, ores of iron, lead, copper, tin, silver and gold; enormous armor plates and sheets of iron; railway bars in one rolling of from eighty to one hundred and sixteen feet long; weldless tires, and a double-throw crank, weighing twenty-five tons. 2. Chemical substances, including drugs, recently discovered chemical substances, a series of the new and beautiful coal-tar dyes, other colors, and pigments. 3. Animal and vegetable substances; ivory, specimens of woods, and mother of pearl, and shells; gutta-percha and India-rubber goods, wax, tallow, soaps, and candles. 4. Agricultural and horticultural implements of every description, including several steam ploughs, traction engines, &c. 5. Machinery in general, but not in motion; railway carriages, railway gates, fire engines, flour and other mills, bread-making machinery, grocers', and confectioners' machines, quartz-crushing machines, telegraphs, &c., &c., &c.

If now we turn our attention to that portion of the British department embraced between the outer portion and the nave, on the south and north respect-

ively, and between the transept in which we have stood, on the east, and the broad transverse avenue heretofore referred to as dividing the exhibition building in two equal parts, commencing on the outside, next Cromwell road, if we pace back and forth between the transept and avenue, we shall find carriages of every style and description known in the United Kingdom; hardware, including metallic bedsteads, chandeliers in ormolu, steel fenders, fire-grates, railway springs, &c.; machine processes, such as chromo-lithography, copper-plate printing, paper collar marking, envelope folding, fret, bristle and block-cutting, medal striking, silk velvet weaving, needle and chain making; leather of every sort; furs and furriers' goods; iron and hardware again; illustrations of civil engineering, to wit: models of bridges, hydraulic graving docks, railway carriage signals, railway viaducts; models in the department of military engineering, as of the principal English fortifications, barracks and hospitals, field and floating bridges, field equipage, tents and ambulances, Enfield rifles, Armstrong guns, rifled projectiles, monster mortars and rifled ordnance; specimens in naval architecture; life-boats, nautical instruments, models of iron-plated ships and other vessels-of-war; glass, and manufactures of glass, in great variety and for every conceivable use to which that material can be applied; pottery, including the most beautiful services in china, parian, earthenware, and terra-cotta; Wedgewood's wares, Limoge's enamels, vases, statuettes, stoves in porcelain and earthenware, chimney and greenhouse pots, jasper and antique wares, earthenware and china, printed by a new process in gold and colors; and, last of all, the most brilliant array of precious metals and jewels the world ever saw.

If now we enter the central avenue—in which we find Durham's statue of the Queen, Jones's Greek temple, with Gibson's tinted statue of Venus, Benson's immense and wonderful clock, the Belfast linen trophy, an extensive case of Liverpool imports, and a statue of Shakspeare—cross the nave, and turn our faces eastward toward the transept we but recently left, we shall encounter, 1. A fine display of pianos and other musical instruments. 2. A magnificent array of furniture of every possible sort, modern, mediæval, and antique. 3. An interesting and picturesque group of Britain's remaining colonies—the Bahamas, with seeds, woods, fibres, cotton, sponges, and shells; the Ionian islands, with their fine collection of manufactured articles; Trinidad, with its minerals, asphaltum, coal, lignite, chemical products, nuts, and other food substances, native woods, skins, fibres, oils, and the like; New Zealand, with mineral ores, gold, coal, sulphur, woods, wools, domestic implements, weapons, seeds, cereals, coffee, textile fabrics; Natal, with a fine show of food substances, skins, horns, woods, flax, fibres, wool, minerals, specimens in natural history, and Kafir manufactures; Cape of Good Hope, with fibres adapted to textile fabrics, and vegetable substitutes for horn; Queensland and New South Wales, with their fine display of woods, wools, cereals, fibres, gums, spices, oils, gold quartz, copper and other ores, clays, pottery, and surgical instruments; Australia, (East and West,) with the finest wheat in the exhibition, other cereals, seeds, and fruits, samples of wool, gold, and copper ores; Victoria, so splendidly represented by her trophy of wools, the products of manufacture and of general industry, and the pyramid of gold, to which reference has already been made; and finally, in the gallery, directly above these last, India, (including Bengal, the northwest provinces, Oude, the Punjab, Burmah, and the Straits settlements,) presenting her matchless array of fibres, teas, oils, gums, resins, and medicinal substances, lac-work, clay figures, straw manufactures, cotton, hemp, carpets, shawls, embroideries, velvets, woollens, ivory, and paintings.

The remaining space in the British galleries on this north side of the nave is devoted to fine displays of paper printing, bookbinding, dressing cases, surgical and philosophical instruments. The open galleries on the south side of

the nave are chiefly filled with textile fabrics of cotton, hemp, flax, wool, silk, carpets, hosiery, thread, lace, &c. The closed galleries next the outer walls on Exhibition road and Cromwell road are devoted to paintings, art designs, architectural designs, drawings, engravings, photographs, and sculpture—the display being the finest ever made by British artists.

But we have not yet completed our survey of the British portion of the exhibition. In the other annex, which we have not entered yet, there are over 360 square rods of space occupied by machinery in motion—a grand display, in no respect unworthy the world's greatest empire. England may well be proud of her share in the great Exhibition of 1862.

OTHER COUNTRIES.

Advancing now from under the east dome, to which point we had returned in our survey of the colonial contributions, and proceeding down the nave to the centre of the central avenue, which, as before mentioned, divides the British from the other departments, we have, first, upon our left, the Italian court, containing a beautiful display of minerals, metals, and other raw materials, vegetable products, wines, &c., Florentine mosaics, bronzes, carved woods, saddlery, decorative furniture, such as inlaid tables, inlaid marbles, &c., a statue of Garibaldi, several fine cases of furs, velvets, silks, straw manufactures, and artificial flowers; the Roman court, with its splendid collections of statues and paintings, together with specimens of inlaid and other mosaics, cameos, bronzes, textile fabrics, and porcelain manufactures; Portugal, with a fair assortment of silk and cotton fabrics, straw manufactures, corks, and wools, and a very fine show of vegetable products, wines, and oils; and Spain, showing mining, quarrying, metallic, animal, and vegetable products, in considerable variety and quantity.

Beyond these several courts, and occupying ten times as much space as these all together, is the most tastefully arranged and most brilliant court within the whole palace. I hardly need say it is the court of France, now, as ever heretofore, unrivalled in the manufacture of jewelry, musical instruments, ornamental glass and porcelain, decorative furniture, paper hangings, silks, fine woollen goods, and fancy articles of every description. The display of these articles, on the floor and in the galleries, and of a thousand others of most substantial and economical value, including a splendid show of agricultural productions—the largest and finest by far in the whole Exhibition—and a large amount of machinery and implements, was worthy of the France of to-day, and fully indicates the proud position she holds among the nations.

The contributions from Algeria, Guiana, and the other French colonies, are also extensive, and of excellent character; showing that those departments, under a liberal form of government, may readily be developed into possessions of much importance.

Beyond the French court we have, on the side of Cromwell road, underneath the foreign picture gallery, and in the entire southern half of the great western transept, to which the French court carries us, the extensive contributions of the "States of the Zollverein." This department ranks next, in magnitude and importance, to the French. It includes Prussia, Saxony, Baden, Bavaria, Brunswick, Hanover, Hesse, Nassau, Oldenburg, Wirtemberg, Mecklenberg, Schwerin, Frankfort, and several other towns and duchies. The articles exhibited are chiefly of the utilitarian sort, and do credit to the resources and skilful industry of the German states. On the south side we shall find raw materials, metallic ores, grindstones, slates, alum salts, iron, steel, copper, coal, wools, cereals, pressed fruits and implements; within the transept, on the floor and in the gallery, on the eastern side, a handsome show of silk, linen, woollen, worsted, and cotton fabrics, specimens of arms and cutlery, musical instruments, clocks, leather, earthenwares, jewelry, specimens of works in amber, &c.

On the west side of this end of the western transept are the contributions of "the Hanse Towns," Bremen, Hamburg, Lübeck—friction balances, carved work in wood, basket work, and fancy furniture from harts' horns.

We stand now under the great *western* dome, and look down the nave in the opposite direction. In the centre of the area beneath the dome are magnificent trophies of the King of Prussia—porcelain, of Bohemian glass, of silver plate, and of arms. Before us, on the left of the nave, and this side of the central avenue, we have, first in order, Belgium, which makes a fine show of hardware, fire-arms, mineral and agricultural products, textile fabrics, silk and velvet goods, cotton, linen, woollen and mixed stuffs, from the government apprentice schools, and a splendid show of Brussels lace in the gallery above.

Next in order come Holland, with a fair display of animal and vegetable substances used for manufacturing purposes, foods, furniture, hardware, linen and woollen fabrics, silver plate, and fine diamonds; Switzerland, showing pianos and other musical instruments, optical and philosophical instruments, watches and watch-making machinery, cutlery, engravings, velvet goods, &c.; Denmark, with its musical instruments, earthenware, carving, work in silver, furniture, &c.; Sweden and Norway, displaying Bessamer steel, copper, and other metals, philosophical instruments, silver work, Swedish silk, national costumes, figures, and portraits; Russia, with her splendid show of minerals, seeds, cereals, flax, hemp, cotton, silk, and wool, and their manufactures, furs, skins, leathers, silver work; Turkey, showing cereals and other agricultural products, silk fabrics, and embroideries, leather and articles of leathern manufacture, filigree work, and carpets; Brazil, well stored with minerals, gold, diamonds, and other precious stones, with garden seeds, nuts, cotton, and manufactured articles; Egypt, making a fine display of embroidered garments, richly mounted saddlery, arms, &c.; Greece, with its olives, figs, raisins, cereals, and manufactured articles; and, finally, Costa Rica, Uruguay, Peru, and Venezuela, with each a small collection of native minerals, vegetable productions, skins, dried fish, and wool. We have reached the avenue, and may return to that portion of the western transept which extends northward from the dome, where we but recently stood.

We now stand in the midst of the Austrian empire, which exhibits, on the lower floor, an extensive collection of cereals, seeds, wools, soaps, wax, mineral products, including coal, sulphur, and rock salt, a fine assortment of wines, Bohemian glass, meerschaum pipes, photographs, maps, books, musical instruments, and a variety of educational appliances, while in the galleries are woollen, silk, and cotton fabrics, ribbons, shawls, and much else of that description. The foreign picture gallery extends from the central tower quite around to the western annex, a distance of 1,400 feet, and is perfectly magnificent. But we shall not be able to visit it now.

OPERATIVE MACHINERY OF VARIOUS NATIONS.

Having thus completed our rapid survey of all courts, except the American, which we have purposely reserved to the last, we pass out from the main body of the palace by one of the great openings at the north end of this transept, and suddenly stand in full view of the vast and magnificent display of the world's machinery in motion! To him who sees in the wonderful mechanical inventions of the day a sure promise of "the good time coming," when the whole human race shall have been lifted up and measurably redeemed from the severity of drudging toil, this is the grandest spectacle of all. See what mighty engines are here!—engines for the propulsion of ships across the seas, for the dragging of monster railway trains, for driving the machinery of great factories and mills, and for the working of mines deep in the earth! Look, too, at the multitude of mills of different kinds—sugar mills, oil-pressing mills, corn mills; and then at the wonderful looms and cotton-spinning machinery, covering so

large an area, and attracting crowds of curious spectators; the brick and tile making machines; the bullet machines; the ice-making, needle-making, and diamond-cutting machines; and the powerful, hydraulic machinery, pouring over and over again, into vast reservoirs, floods of water, with a roar that suggests the mighty Niagara! And, listen a moment! was there ever before, under one roof, unless it were the vault of heaven, such a clash and blending of hum and whirr, and rattle, and clank, and roar, and champ, and hiss? To many it is, doubtless, the sum of all dissonances: to my ear, it is the grand choral of a glorious prophecy!

If we enter and examine, we shall find that here, as elsewhere, in magnitude and display, England is ahead, more than half of the entire space within the annex being occupied by her contributions. But then other nations are here: France, with splendid locomotives, railway carriages, models of different systems of signals, miners' wagons, road wagons, swing gates, composing machines, glazing machines, circular and other looms, turbine wheels, punching machines, wood-working machinery, tools of various kinds.

Belgium, next in rank, contributes machinery for making sugar, paper, brick; for washing, spinning, napping, pressing; implements and apparatus for shearing, carding, brewing, making gaseous drinks; mining; scalding and peeling machines, flax-drawing, winding, and spreading machines, steam-engines, blast-blowing machines, and much else.

Prussia displays extensive machinery for working in the metals, a peat-cutting machine, distilling apparatus, a steam lithographic press, rotary engines, ice-making machines.

Austria shows a caloric engine, a four-cylinder locomotive, lithographic and other presses, a machine for cutting out linen, screw and nut cutting machines, a portable four-horse engine, to be fuelled with straw, and looms of various kinds.

And then come Sweden and Denmark, with rotary and other steam-engines, fire-engines, nail-rolling machines; Italy, with a novel atmospheric railway, an electric loom, machines for spinning, weaving, and for winding cocoons, and an amusing collection of antiquated agricultural implements, such as might have been used in the time of Virgil; Switzerland, displaying power looms, a paddle-wheel engine, &c.; and, finally, the most inconspicuous, but not the least important of all, America, with a power engine, a loom for weaving tufted carpets, &c., and a few other machines, mixed in with those of Great Britain.

AMERICA AT THE GREAT EXHIBITION.

The circumstances of the non-representation of the United States as a nation are familiar to the American people, who will condemn or excuse those who are partially responsible therefor, according as they appreciate or do not appreciate the needs and possibilities of American industry.

The war which has so sadly divided and distracted our country since the first announcement of the Exhibition must, necessarily, have prevented that extensive and imposing display of the products of our national industry and genius which it would otherwise have been our duty to make; but it is nevertheless susceptible of demonstration, that if the proper steps had been taken by the government, and at the right time, the United States might and would have made such an exhibition of its resources, capacities, progress, and power, as, in view of our domestic troubles, would have surprised the other nations, added much to our renown, and contributed more nearly our share to the progress of the world's civilization.

What was known at the exhibition as "the American court," consisted of such mineralogical collections from California, Nevada, and Lake Superior, and such food substances, machinery, implements, manufactures, musical instruments, and works of art, as a few enterprising Americans took or forwarded to

London at the latest moment, in spite of all discouragements, and at great personal expense. Thanks to the early, zealous, and persistent efforts of Colonel B. P. Johnson, secretary of the New York State Agricultural Society, and chairman of the executive committee of the temporary organization known as the American Board of Commissioners, a large proportion of the articles thus forwarded were from New York; the rest, in varying proportions, from the eastern, western, and Pacific States. But even these contributions, on their arrival at the exhibition palace, found the doors closed against them, on account of the formal resignation by our government of the space which had been assigned to the United States by her Majesty's commissioners; and it was only by the generous courtesy of the royal commission that the energetic and persevering general agent of what had been the American board, Mr. J. E. Holmes, of Ohio, aided by the active influence and high reputation of Colonel Johnson, whom circumstances detained at home until a late period in the progress of the Exhibition, succeeded in getting the reassignment of a small amount of space for such articles as were already there, or known to be on the way, and in securing the equivalent of a recognition of this country. But many valuable articles, including some important machines, which had been prepared and transported at great expense, were entirely excluded.

In view of these facts, and of others which I do not deem it necessary to name in this connexion, great credit is due to Mr. Holmes for the important services rendered by him.

The location of the United States court was at the south end of the eastern transept, immediately at the corner entrance to the British department. It really consisted of *two* courts—an inner and an outer one—the two connected by high, arched doorways, over which hung the armorial ensign of the republic of the United States and a tastefully festooned star-spangled banner.

The few, but novel and valuable, articles, mostly of a utilitarian character, were judiciously arranged, and received marked attention from the multitudes who daily thronged to see the curious pumps, reapers and mowers, ploughs and other implements, signal telegraphs, guns, steam fire-engines, and the various machines for spacing and boring, dressing flax and fibre, making boots and shoes, milking, &c., within the *inner*, and the sewing machines, pianos, carriages, and paintings within the *outer*, court; while in the western annex the great power engine which propelled so much of the machinery, and the remarkable loom for weaving tufted carpets, were second in interest and importance to no other contribution therein displayed. Among the works of art, Mr. Brady, of New York, exhibited a number of photographs, which were even superior to the almost perfect specimens in the Austrian court—which were, indeed, the finest works of the kind within the Exhibition, but which arrived too late for inspection by the jurors. The fine landscape paintings by Mr. Cropsey were, of themselves, a noble vindication of the American genius for painting, and the statuary of our own gifted Story and Powers has vindicated our title to rank the first among modern nations in the art of sculpture!

COMPARISONS AND DEDUCTIONS.

Did my limit of space permit, it would be interesting to compare, in detail, the different nations represented at the great Exhibition, and to show how correctly the characteristics of each are illustrated thereby:—how Great Britain still holds her position as superior in the manufacture of most earthenware, cotton cloth, the coarser woollen fabrics, and in those ponderous engines and machines requisite in mining, metallurgy, and the extensive manufacture of the classes of articles just named;—how France excels in the production of articles of luxury, such as silks, laces, embroideries, fine cloths, porcelains, jewelry; in the fineness and exquisite tastefulness of her work in the precious metals; in the quality of her surgical and philosophical instruments; in those wonderful

applications of chemical science which have so rapidly advanced the practical arts of tanning, coloring, dyeing, lithography, photography, &c.; perhaps, also, in the art of military engineering;—how Austria and the German States hold rank in the production of salts, the manufacture of woollen stuffs of certain kinds, of musical instruments, of some classes of chemical apparatus, and educational appliances;—how Belgium still competes with the world in the manufacture of fine lace, good rifles, and various kinds of hardware;—how Italy still maintains her position in the production of raw silk, in the manufacture of straw hats, carving, inlaid tables, Florentine mosaics, &c.;—and how America is clearly destined to surpass them all in those utilitarian inventions calculated to diminish human toil, by increasing the power of producing, in greater perfection, the necessaries and luxuries of life, and likewise in the production of the highest works of art! But a whole volume would be required for a profitable discussion of this sort; and in order to facilitate the labor of those who may be interested in the comparison of actual results, the following synopsis of the number of entries made, and proportion of medals won, in the thirty-six industrial classes, (which alone were subject to awards,) by a few of the nations represented:

Great Britain made 6,965 entries, and won 1,640 medals, or one for every 4.24 entries.

The British colonies made 3,245 entries, and won 768 medals, or one for every 4.22 entries.

France made 3,636 entries, and won 1,381 medals, or one for every 2.63 entries.

Zollverein States made 2,875 entries, and won 705 medals, or one for every 4.07 entries.

Italy made 2,070 entries, and won 327 medals, or one for every 6.33 entries.

Austria made 1,410 entries, and won 496 medals, or one for every 2.84 entries.

Spain made 1,133 entries, and won 120 medals, or one for every 9.44 entries.

Belgium made 862 entries, and won 239 medals, or one for every 3.6 entries.

Turkey made 787 entries, and won 176 medals, or one for every 3.37 entries.

Russia made 729 entries, and won 152 medals, or one for every 4.13 entries.

United States made 113 entries, and won 57 medals, or one for every 1.98 entries.

The system of selecting jurors was as perfect as it was possible to devise, and the lists, comprising in all 615 names, show that the most competent men that the world could furnish were chosen for this important work. Great excellence determined the awards of medals, without reference to competition between exhibitions, and "honorable mention" was awarded to such articles as were entitled to special notice, and were yet not deserving of medals. Thus, in the whole exhibition there were 7,000 medals awarded and about 5,300 honorable mentions, the proportion of awards being greater than in 1851 but less than in 1855. The total of awards to the American department was eighty-seven—a much larger proportion than was received by any other nation.

But mere awards, whether of medals and honorable mentions, or of medals alone—which is the better test—do not decide the real merit of the exhibition or of any part of it; we must also know upon what *classes* of articles those honors were conferred. To meet, to some extent, this demand, the following tabulated synopsis is presented:

Table showing the number of Medals awarded in the several Industrial Classes to some of the leading countries represented at the International Exhibition of 1862.

No. of class.	Title of Industrial Classes.	Great Britain.	B. Colonies.	France.	Zollverein States.	Italy.	Austria.	Spain.	Belgium.	Turkey.	Russia.	America.
I	Mining, Quarrying, Metallurgy, and Mineral products	86	66	34	41	21	30	7	12	..	12	1
II	Chemical Substances and Products and Pharmaceutical processes:											
	Sec. A. Chemical Products	68	14	62	43	10	26	6	11	7	..	4
	Sec. B. Med. and Pharm. products and processes	8	1	8	6	..	1	..	..	..	..	1
III	Substances used for food:											
	Sec. A. Agricultural Products	13	76	86	16	17	26	21	12	6	21	2
	Sec. B. Preparations of food as sold for consumption	30	65	106	13	40	30	2	4	2	5	..
	Sec. C. Wines, Spirits, Beer, &c., and Tobacco	9	92	91	71	40	56	21	8	8	13	..
IV	Animal and Vegetable substances used in manufactures:											
	Sec. A. Oils, Fats, Wax, and their products	19	7	25	10	9	10	8	8	..	3	2
	Sec. B. Other Animal substances used in manufactures	25	61	58	15	..	14	3	2	..	..	1
	Sec. C. Vegetable substances used in manufactures	45	244	112	35	42	63	2	14	28	27	2
	Sec. D. Perfumery	10	6	17	....	3	..	1	2	3	..	..
V	Railway Plant, including Locomotives and Carriages	15	1	5	6	1	3	..	3	..	..	..
VI	Carriages not connected with rail or tram roads	23	....	5	2	..	..	..	1	..	2	1
VII	Manufacturing Machines and Tools:											
	Sec. A. Machinery employed in spinning and weaving	19	....	10	1	2	..	..	3	..	..	3
	Sec. B. Machines, &c., used in working wood and metal	42	....	24	12	1	2	..	4	..	..	1
VIII	Machinery in general	67	2	29	13	..	3	..	6	..	..	20
IX	Agricultural and Horticultural Machines and Implements	47	9	11	2	6	4	..	..	..	1	6
X	Civil Engineering, Agricultural and Building Contrivances:											
	Sec. A. Civil Engineering and Building Contrivances	20	5	32	10	4	8	..	1	..	1	..
	Sec. B. Sanitary Improvements and Constructions	10	6	6	....	..	3	..	4	..	1	..
	Sec. C. Objects shown for Architectural Beauty	22	3	14	6	6	1	1	7	..	3	..
XI	Military Engineering, Armor, &c., Ordnance and Small Arms:											
	Secs. A & B. Clothing and Accoutrements, Tents, &c., and Military Engineering	10	....	4	....	..	..	1	..	1	..	..
	Sec. C. Arms and Ordnance	28	....	14	6	6	1	1	7	..	3	1
XII	Naval Architecture, Ships, Tackle, &c.:											
	Sec. A. Ships for War or Commerce	15	....	1	....	..	1	..	..	..	..	1
	Secs. B & C. Life Boats, &c., Ship's Tackle	17	4	6	....	..	..	..	..	..	2	1
XIII	Philosophical Instruments and processes depending on their use	51	....	25	15	3	4	..	2	..	..	1
XIV	Photography and Photographic Apparatus	26	7	32	7	1	4	..	1	..	1	..
XV	Horological Instruments	36	....	19	11	..	3	..	..	..	..	..
XVI	Musical Instruments	27	....	34	21	2	13	..	6	..	..	2
XVII	Surgical Instruments	32	....	20	3	1	5	..	..	..	1	1
XVIII	Cotton	32	7	23	16	3	8	..	4	..	2	..
XIX	Flax and Hemp	34	....	10	22	4	8	..	11	..	..	..
XX	Silk and Velvet	33	....	80	14	38	9	3	..	8	5	..
XXI	Woolen and Worsted, including mixed fabrics generally	83	5	74	35	..	26	5	15	7	6	..
XXII	Carpets	14	8	9	2	..	1	..	4	4	..	..
XXIII	Woven, Spun, Felted, and Laid Fabrics, shown as specimens of Dyeing and Printing	19	2	37	11	1	8	2	3	..	2	1
XXIV	Tapestry, Lace, and manufactures	32	9	40	6	2	..	3	..	3	4	
XXV	Furs, Feathers, and Hair:											..
	Sec. A. Skins and Furs	9	5	2	2	..	1	..	1	1	8	
	Sec. B. Feathers, and manufactures from Hair	9	....	5	2	..	1	..	1	..	..	..
XXVI	Leather, Saddlery and Harness:											
	Sec. A. Leather	21	2	23	23	4	5	..	8	..	5	
	Sec. B. Saddlery and Harness	24	2	2	1	..	1	1	..	..	..	..

Table showing the number of Medals awarded, &c.—Continued.

No of class.	Title of Industial Classes.	Great Britain.	B. Colonies.	France.	Zollverein States.	Italy.	Austria.	Spain.	Belgium.	Turkey.	Russia.	America.
XXVII	Articles of Clothing:											
	Sec. A. Hats and Caps	5.	....	5	2	1	3	2	2	..	2	..
	c. B. Bonnets and Millinery	3	2	10	2	3	1	1	..	..	..	..
	Sec. C. Hosiery, Gloves, and Clothing	20	....	37	10	2	12	2	4	5	1	..
	Sec. D. Boots and Shoes	25	5	12	5	..	6	1	2	4	4	..
XXVIII	Paper, Printing, and Bookbinding:											
	Sec. A. Paper, card and mill-board	6	....	10	13	2	3	..	..	..	..	..
	Sec. B. Stationery	31	1	11	18	..	3	..	3	..	..	3
	Sec. C. Plate, Letter Press, and other modes of Printing	33	....	29	17	3	5	..	2	..	..	..
	Sec. D. Bookbinding	12	4	11	2	3	3	..	1	..	1	..
XXIX	Educational Works and appliances	76	30	70	20	19	23	..	4	..	1	..
XXX	Furniture, Upholstery, Paper-hanging, Papier Mâché	39	5	36	9	13	6	1	5	..	3	..
XXXI	Hardware:											
	Sec. A. Manufactures in Iron	96	1	37	48	..	20	..	4	..	3	..
	Sec. B. Manufactures in Brass and Copper	23	....	44	7	..	..	..	3	..	..	..
	Sec. C. Manufactures in Tin, Lead, Zinc, and Pewter	5	....	....	....	..	1	..	1	..	..	..
XXXII	Steel:											
	Sec. A. Steel Manufactures	21	....	....	2	..	..	..	..	..	..	..
	Sec. B. Cutlery and Edge Tools	31	2	16	11	2	6	..	2	..	..	2
XXXIII	Works in precious Metals, their imitations, and Jewelry	26	10	35	16	6	8	1	..	..	4	..
XXXIV	Glass:											
	Sec. A. Stained Glass and glass for decoration	8	....	11	2	3	..	..	7	..	..	..
	Sec. B. Glass for household use and fancy purposes	9	....	11	3	1	7	..	..	..	1	..
XXXV	Pottery	19	....	14	6	2	2	1	1	..	1	..
XXXVI	Dressing Cases, Despatch Boxes, and Travelling Cases	8	....	7	3	..	4	..	..	..	2	..

GENERAL CONCLUSIONS.

It is the office of all great events to teach the world a higher wisdom; but it is not always, perhaps it is very seldom, that the lessons thus taught are carefully studied and faithfully applied. An international exhibition, like the one just closed, gathering together the thinkers and workers of all lands, with the varied and wonderful products of their science and art, under one friendly roof, has a profound significance, and cannot fail of the most beneficent results. The influence of the first was distinctly apparent in this last, and each successive exhibition will give a new and powerful impulse to the industries of all lands; exploding old errors, teaching new and better methods, stimulating all to attain to the highest possible excellence, making the knowledge of each the common property of all, strengthening each with the added strength of every other.

Nor is it less demonstrable that, by more widely diffusing the blessings of civilization, and uniting all peoples more firmly in the bonds of mutual interest and friendly association, these great world's gatherings must tend to the earlier realization of a universal peace among men.

Let us hope that when the nations again meet, the republic of the United States of America, triumphantly vindicated, integral, and grounded upon the sure foundation of truth and justice, will stand in their midst the peer of the first.

SOME OUTLINES OF THE AGRICULTURE OF MAINE.

BY SAMUEL L. BOARDMAN, AUGUSTA

It may be well, before speaking of the agricultural condition and practices of this State, to glance at its general outlines of situation, climate, soil, and productions.

The State of Maine occupies a little less than one-half of the surface of the New England States, and extends from latitude 43° to 47° 30′ north, and longitude 5° 56′ to 10° 10′ east from Washington, its extreme length, from Kittery Point to the northeastern angle of the State, being 350 miles, and its greatest width, from Quoddy Head to the New Hampshire line, 200 miles. The area of the State comprises 31,766 square miles, or 20,330,240 acres. According to the census of 1860, the number of acres in farms was 5,700,675, while the number of acres under cultivation was but 2,677,136. Population in 1860, 628,276.

The climate of Maine is variable. We have extremes of both heat and cold. The temperature ranges between 100° above and 30° below zero, but the changes are seasonable and do not at all interfere with the personal health of the inhabitants. The season of active agricultural labor is short, as winter rules half the year; and although vegetation is late, it is rapid and vigorous. The growing season begins, usually, about the middle of April, extending to the middle of October, although the period of the most active growth lasts only for three or three and a half months. The apple trees blossom, on an average, from May 26 to June 6. Indian corn is planted from May 25 to June 1, and is ripe for harvesting about the first week in September; and the work of securing the crop of hay begins about the first of July and continues through the month. In situations along the coast the summers are rendered more pleasant by the recurrence of sea breezes, and in counties in the eastern part of the State the atmospheric temperature is somewhat modified by the vapors and fogs rising from the Gulf Stream, which, in these latitudes, sweeps the shores. Droughts of brief duration but great severity frequently occur during the summer months, although the annual average rain fall is not far from forty inches. Occasionally late spring or early autumn frosts seriously damage the crops of corn, beans, and the less hardy cereals. The surface of the land contiguous to the seaboard is generally flat, and its character sandy. Back from the coast region it is pleasantly varied with hills, valleys, and plains. One marked feature in the physical geography of the State is the absence of continued ranges of mountains, or even elevations approaching the appellation of "high hills," although in the northwestern portion there are numerous detached elevations, which may quite properly be regarded as the sentinel outposts of the White Mountains. The highest elevation of land in the State is Mount Katahdin, which rises 5,385 feet above the level of the sea. Almost every variety of soil is found in the State—sandy, clayey, gravelly, rocky—and of various degrees of fertility. The coast lands are light, but with the application of considerable quantities of marine manures produce average crops. In the valleys drained by the Kennebec, Penobscot, Androscoggin, Sandy, and smaller rivers, there are rich fields admirably adapted to grazing purposes, and comprising the best-farmed sections of the State, being in a high state of cultivation, and yielding productive crops of every description. In the eastern part of the State there are extensive tracts of plain land, generally of a light character,

originally covered with a white pine growth, and of a fair degree of fertility; but from the increased attention heretofore given to lumbering, their culture has been somewhat neglected. Along the coast in some counties are salt marshes of considerable extent, which are used for the purpose of cutting hay, and are generally owned in sections or lots by those having farms remote from the coast. The underlying rocks throughout the State are chiefly primary, with a large division of those that refer to the transition period, while in the eastern portion is an important region of the lower secondary formation. Fisher says: "Everywhere it has alluvial and diluvial deposits, and vast igneous formations, not only in the interior, but forming a barrier against the ocean surge along a considerable part of an immense sea-coast." The mineral deposits are various and extensively distributed throughout the limits of the State, and, through the instrumentality of the scientific survey, (recommenced in 1860, and now in progress under the most eminent talent in the various departments of science,) many important but hitherto unknown deposits of valuable minerals have been discovered. The one most worthy of mention is that of an extensive deposit of iron, discovered the past season (1862) in No. 13, range IV, Aroostook county. This ore is of the same quality as that obtained from Woodstock, New Brunswick, which, according to experiments conducted by the English government, was the only iron from a large number tested that would withstand the pressure of a 250-pound ball from an Armstrong gun. The ore is a compact red hematite, containing about 30 per cent. of metallic ore, is favorably located for mining and smelting, is inexhaustible in extent, and its discovery is regarded as highly important at this time. Granite, limestone, and marble constitute the principal mineral products, the two former being extensively quarried; and the latter, of which some new deposits, excellent in quality and large in extent, have recently been found in Aroostook, is quarried to a limited degree. Lime is abundant in the southeastern section of the State, and is burnt in great quantities for exportation. It is also found in many other localities.

In that part of the State extending from the Kennebec to the Penobscot rivers, in the southern portions of Piscataquis county, are extensive beds of roofing-slate, which have been quarried in a number of places, especially at Brownville, where a large number of men are continually employed, and slates to the value of $75,000 are annually worked out. Lead has been found both in the extreme eastern and western parts of the States, and iron has for many years been smelted in considerable quantities at the Mount Katahdin and Pembroke mines. Bog-iron ore is so common as to be put down as occurring in almost every county in the State, in many of which it has heretofore been worked. The upper silurian limestones, suitable for the manufacture of hydraulic cement, which is a most important article in building, occurs in several localities in Eastern Maine. Soapstone, sandstone, and brecciated rocks of many varieties are found; also jasper, including the beautiful greenstone trap, and its varieties, and porphyry. Fisher remarks: "The trap-dykes are numerous and exceedingly distinct; they cut through most of the other rocks, and produce upon them most distinctly those peculiar effects which, to a demonstration, prove their igneous origin; while the diluvial deposits, the boulders and ruins, the diluvial furrows in the rocks, the sea shells now adhering to and inherent in rocks which once formed the sea-coast, although now elevated 26 feet above the water, a salt spring at Lubec, and many other interesting phenomena, illustrate parts of the scientific geology of Maine." It has been estimated that one-tenth of the State is covered with water. The rivers are numerous, and many of them large and important, affording, in nearly every instance, excellent opportunities for mills, although the rapids in them interrupt their navigation to a great extent into the interior. The northern section is drained by the St. John and its tributaries, the eastern by the Penobscot, the central by the Kennebec, and the western by the Androscoggin and the

Saco. Lakes and ponds are found in great numbers, and many of them are of such an extent as to form a characteristic feature in the country; and while many of them are noted for the picturesqueness of the surrounding scenery, not a few are fast becoming useful channels of interior communication, and are likely to become still more important as fields for the propagation of fish, when the experiments which have been begun, and which have thus far proved so successful, shall have been extended to those ponds suited to the enterprise. The largest in extent are Moosehead, Chesuncook, Pemadumcook, Umbagog, and the Schoodic. The islands on the coast are numbered by the hundreds, ranging, in extent, from sixty thousand acres of inhabited and fertile land, to those numberless smaller islands which are little else than a mass of rocks. Upon many of these islands sheep have, within a few years, been introduced, and they are likely to become the best lands for sheep ranges that we have in the State. Away from the worrying and dangerous chase of dogs, and protected from the cold winds by the low, thick evergreens with which the shores of these islands are studded, they offer most excellent situations for this branch of husbandry. A mixed course of husbandry is pursued by the farmers. There is no one branch of operations which farmers engage in as a specialty, but all the staple crops are usually grown upon each farm, and a mixture of stock, including horses, sheep, neat cattle, &c., are kept. The barns and farm buildings are in good order, many of them being elegant and expensive, and all are well adapted for their purposes. The size of the farms ranges from 100 to 300 acres.

THE FARM STOCK OF MAINE.

NEAT CATTLE.

Maine is pre-eminently a stock-growing region. It has rich pastures, and furnishes a large amount of that indispensable staple in stock husbandry, good hay. The value of the farm stock, as furnished by the census of 1860, was $15,437,380. Let us present some notes on the early history, introduction, and present condition of the various breeds of neat cattle.

Maine, until 1820, was a part of Massachusetts; consequently, our early history of the introduction of neat cattle must include those brought to New England. In Hubbard's *New England*, p. 34, the author says: "In March, 1624, Mr. Winslow's agent for the colony arrived at Plymouth, in the ship Charity, and, together with a good supply of clothing, brought a bull and three heifers, which were the first cattle of the kind in this part of America." These were cattle which came from parts of Devonshire and adjoining counties, where Devon cattle equally prevailed. Subsequently to this, in 1630, it appears that out of the seventeen ships which arrived in New England thirteen sailed from Devonshire and its immediate vicinity, and all of them, probably, brought over more or less stock of the Devon breed. So early as 1630, Captain John Mason, an enterprising and energetic pioneer, had several plantations on the Piscataqua, now including the towns of Kittery and Berwick, in the western part of the State. The cattle imported by Captain Mason were Danish;* and although, prior to 1630, he had imported a few cows for the purpose of affording milk for the workmen on his estates, in the two or three years following he "made frequent importations of bulls, oxen, and cows" for the purpose of stocking his somewhat extensive farms. They were chosen on account of their capacity for labor and endurance of the rigors of our climate. They were large, of powerful make, and yellow color. In 1634 there were some three hundred cattle upon Mason's patents, mostly of this breed; and six years later, according to Barber, "it was judged that they had 12,000 neat cattle in New England," and some writers assert that of this number eleven

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* Transactions New Hampshire Agricultural Society for 1854. Article by C. E. Potter, esq.

hundred were, without doubt, Devons, and the remainder the Danish cattle imported by Captain Mason. Dr. Holmes says: * "Now these Denmarks of Captain Mason, thus distributed through Maine, New Hampshire, and Massachusetts, soon became mixed with the cattle that had been imported into the Plymouth and Massachusetts colonies, and which may be mainly called Devons, and formed that cross or breed of cattle denominated Natives," or, in other words, the "Old Red Stock of New England." But few facts can be obtained concerning the importation of cattle into this State between the dates above mentioned and 1791–'92; but it is probable that they were occasionally brought in by masters of vessels who traded with different parts of Europe and with the West Indies. In 1791–'92 the late Mr. Charles Vaughan, who, with his brother, the late Benjamin Vaughan, LL.D., both gentlemen largely interested in agriculture, had previously migrated from England and settled on an extensive estate in Hallowell, imported a number of cattle from England. Their first importation was made in 1791, and consisted of two cows and two bulls, the animals arriving in the Kennebec river in the fall of the year. The bulls were selected from the cattle in the Smithfield market, and the cows from the milch farms near London. These cattle were probably the Bakewell breed, which was an improvement of the Long Horns, as they were called. During the war with England, in 1814, an English vessel was captured and taken into Portland, that had cattle on board. A bull from this lot, a few years subsequently, stood in some part of the Kennebec valley, and was known as the "Prize Bull." He left some good stock. "Up to 1718, therefore," says Dr. Holmes, "the *native* cattle of Maine, so called, and, indeed, of all New England, were a mixture of the Denmarks, imported by Mason; the Devons, brought over by the pilgrims of Plymouth, and, probably, of some black cattle, brought at some time from the West Indies or the Spanish Main; the Vaughan importation, and the "Prize Bull." There were also occasionally found some polled or hornless cattle, which were probably introduced from England or from some of the British provinces adjoining us."

About the year 1817 an increased attention was given to the rearing of stock. At this time the old "Massachusetts Society for Promoting Agriculture" (many farmers in the District of Maine were members of this society) offered a premium of $100 for the importation of a thorough-bred Durham short-horn bull. This resulted in the procuring a fine animal, imported into Northboro', Massachusetts, by the late Stephen Williams, esq.—the first short-horn bull imported into the United States—at a cost of about one thousand dollars. He arrived November 5, 1817. He was sired by Denton, by Comet, by Favorite, &c., &c. His dam was by Baronet, grand-dam by Cripple, &c. He was called "Denton 2d." This arrival was kept in Northboro' and Worcester until 1827, when he was presented by Mr. Williams to Dr. E. Holmes, of Gardiner, in this State. He was the first thoroughbred Durham short-horn ever brought into Maine, there having been a few half-bloods previously introduced. Denton was at this time about seven years of age. He stood a part of the following season at Gardiner; afterwards two seasons at Livermore, and was from thence carried to Starks, in Somerset county, where he died of old age in April, 1830. Other importations were made by General Robinson, of Hallowell, and John Davis, of Augusta.

The first Hereford introduced in Maine was a grade bull, "Young Sir Isaac," brought into Hallowell, in 1830, by Sanford Howard. This animal took the Hereford portion of his blood from a bull of the Hereford breed, presented to the "Massachusetts Agricultural Society" by Admiral Sir Isaac Coffin. About fourteen years later, 1844, J. W. Harris, of Hallowell, purchased of Messrs. Sotham & Corning, Albany, New York, (who imported this stock from England

* Agriculture of Maine, 1855, p. 80.

in 1841,) the full-blooded Hereford bull "Albany." He stood in various towns in Kennebec county, and sired some of the best working oxen ever raised in Maine. Subsequently to this, a bull and a heifer of this breed were imported from England into Searsport by Captain Phineas Pendleton.

The Devons, although beautiful and compact and well adapted to the various purposes of a grazing country, are not found in great numbers in this State; yet they give promise of becoming a prevailing and favorite breed. "They are as large as the fertility of Maine soils generally are capable of feeding fully and profitably." The first of this breed sent to Maine was by Isaac Thorndike, esq., of Boston, to his farm in the town of Jackson, Waldo county, in 1834. It was a full-blood Devon bull, from the Patterson herd in Maryland. From this animal grades were obtained on the Durham and other stock of the vicinity. Subsequent to this full-bloods were obtained by Messrs. Percival, of Waterville, Mr. Mitchell, of Pittston, Mr. Harris, of Dixmont, J. F. Anderson, esq., of South Windham, and Mr. Joseph Tufts, of Paris. The two latter gentlemen are quite largely engaged in breeding this class of stock.

In 1852 or 1853 William S. Grant, esq., of Farmingdale, purchased a thoroughbred Jersey bull and heifer. The Jerseys are now quite extensively disseminated in many parts of the State, especially in the rich grazing district of the Kennebec country, in which section there is a number of gentlemen engaged in breeding them.

Among the first importers of Ayrshires from Scotland to this country appear the names of Captain Randall, of New Bedford, Massachusetts, and Hon. J. P. Cushing, of Watertown, Massachusetts. From these two herds several animals were brought into Maine by enterprising farmers. The dates of these importations we are not able to determine. How extensively this breed has become spread throughout our State, or how careful breeders have been to preserve the purity of the blood, we cannot say. It is to be feared, however, that the care necessary for the perpetuation of valuable properties in stock—and this applies to one breed as well as to another—has not been so fully attended to as is necessary in order to preserve these characteristics. In 1852 Dr. Holmes wrote as follows: "We have had all the well-defined breeds of English cattle brought into Maine, except the Alderney and West Highland. But very few of our farmers, however, make a systematic business of breeding any particular breed of cattle. They have no system at all in this business, but are continually mixing and crossing anything and everything that comes to hand." Notwithstanding the truth of this at the time—and, to a limited extent, even now—yet there is a large number of breeders who keep their breeds pure and choice. There has also been a decided improvement in the general character of all the breeds of stock, which is due to the high character of the animals of the different breeds that have been introduced; so that the present excellent condition of our working oxen and cows is traceable to these thoroughbred animals and their grades.

Agricultural societies, by offering premiums for the importation of choice breeds, have contributed much to elevate the character of our neat cattle and other stock, and have accomplished a work that would not have been so quickly done by individual enterprise. If the only proof of the benefits derived from the establishment of the old "Massachusetts Society" were found in the importation of the single bull, "Denton," into this State, it would be a convincing argument in favor of agricultural societies. That one animal has been of incalculable worth to the State of Maine. Another good work done by these societies in the matter of stock-breeding has been in the classification of breeds, and offering premiums for each distinct one. Previous to 1845 stock was not classed for premiums by the societies then existing in Maine, and premiums were awarded for the *best bull, best cow,* &c., &c. Since then, by awarding premiums to distinct breeds, societies have helped greatly to induce

farmers to have a more judicious care in breeding, and in this way have contributed directly to the development and perpetuation of known excellencies in breeds. It could not have been so well done by any other method.

In breeding stock, our farmers have paid too great attention to size, leaving other important qualities in the background. The aim has been to produce fancy stock—steers and oxen well matched for color, form, size, &c.; and by following this plan our working oxen are unsurpassed for hardiness and good working qualities, but our cows are not celebrated as milkers. We are glad that the true policy is becoming understood, and that breeding for the dairy is beginning to receive increased attention, while the other is not neglected.

From the above historical sketch of the importation of choice breeds into Maine, with the careful breeding and close attention to purity of blood which, in many cases, have marked the course of their breeders, a very correct opinion of the present condition and character of our neat stock can be obtained. We have preferred to give this historical sketch, instead of remarking upon the characteristics of the various breeds as they are now well understood by all intelligent farmers.

HORSES.

This State has not been less celebrated for its horses than for its neat stock, while of both we have now, and have heretofore had, some of the best specimens to be found in the New England States. The number of horses by the census of 1860 was 60,741.

It is probable that the early residents of Maine derived their first breeds of horses from Massachusetts and New Hampshire. Messrs. Gorges and Mason, who were the proprietors of that portion of Maine west of the Kennebec river, and who took great pains to introduce neat stock into this State, probably brought horses also, which were disseminated by early settlers throughout the extent of their settlements. Previous to the days of agricultural societies, the introduction and improvement of stock rested upon individual enterprise; but of these no records have been transmitted to us. In the early records of the county of York, there are but one or two instances where horses were made the subject of public action. In 1653 we find the following order, made by the general court of Massachusetts, for the valuation of horses, and it is copied here as a specimen of the curious records of the past:

"*Att a Generall Court of Eleccon held at Boston the 18th of May*, 1653.

"Wheras the order made to regulate, in point of rating, for the countries use, provides how horses, mares, and colts should bee valued, which at present is farr below what they are worth: for redressing of which this court doth order that henceforth ev'y mare, horse, or gelding, of Foure yere's old and upwards, shall bee vallued at Sixteen pounds; and of Three yere's old at Tenne pounds, and of Two yere's old and upwards at Seaven pounds, and at One yere old at Three pounds tenne shillings, any Lawe or Custome to the Contrary notwithstanding. And, further, it is ordered that this Lawe shall Continue for two yere's onely, except the Generall Court shal see Cause to Continue or alter it."

It would be interesting to the agriculturists of the present day to follow out the early history of the introduction and breeding of this useful animal, to give a connected account of the different families or breeds that have been introduced into our State, and by whom they were introduced, and to trace the results that have followed from the course of breeding, though pursued with but little system, and often on incorrect principles; but it is impossible to do this, there being no date from which to start such a work, or to carry it along through the early years of our agricultural history. Up to about 1816 the horses of Maine were, doubtless, a collection of what the farmers of England would call "horses of all work," and this definition would apply, with much correctness, to the horses of Maine of the present day. In 1855 the secretary of the State Agricultural Society, in his annual report, wrote as follows:

"At present there are three breeds of horses that may be considered as being predominant in Maine, viz: Messengers, Morgans, and Black Hawks. These breeds, however, are not kept very distinct, being crossed and mixed up in no very systematic manner, according as the fancy or convenience of the farmers who wish to raise colts may dictate. It is not a little remarkable that, notwithstanding this lack of system in breeding, some of the fleetest trotters in the Union were raised in Maine."

Imported Messenger, according to the "American Turf Register," was brought from England by Mr. Benger in 1791, and landed in New York in the fall of that year. He stood two years near Philadelphia, and was afterwards sold to Mr. Henry Actor, and stood one season on Long Island. After this he was carried to Dutchess county, New York, and in 1808 he died on the farm of Mr. S. Cook, on Long Island. The "Winthrop Messenger," or, as he is best known by residents in this State, the "Old Messenger," was a grandson of "Imported Messenger," and was purchased in Paris, Oneida county, New York, by Alvin Hayward, esq., of Winthrop, and brought by him into that town about the year 1816. Those who have seen him describe him as "a large, white, muscular horse, with a clumsy head, but well proportioned body and legs." His form and general appearance indicated a powerful animal, but he never exhibited any of those qualities which would have entitled him to be called "a fast horse." When his colts came into service they were found to be superior roadsters, and very many of them became fast trotters, and were possessed of great endurance. On this account they were sought after in the markets, and our farmers sold off their best animals, which were carried to other States, where they were trained to the course, and, becoming celebrated as trotters, gave honor and reputation to the stock horses of States where they were subsequently owned, when, in fact, the reputation should have been given to Maine and her horse-breeders. The names of some of the descendants of "Winthrop Messenger" raised in Maine,* which have been celebrated as trotters, will show the truth of this remark—Fanny Pullen, Tacony, Lady Swan, Henry, Lafayette, Celeste. Among the others were Ice Pony, Tom Benton, Independence, D. D. Tompkins, Zachary Taylor, Mac, &c. So eminent a writer as Sanford Howard, esq., in 1852, made the following remark: "Maine has, until within a few years, furnished nearly all the trotting stock of any note in the country." "Old Messenger" was kept as a stock horse, in various parts of this State, until between twenty and thirty years of age, and died in Anson, Somerset county, in 1833 or 1834. The Messengers were excellent horses for the road or for work, although they were late in maturing. The name became a standing recommendation, and was even applied to horses to whom it did not belong, as an inducement to purchasers.

While the Messenger stock was in the height of its popularity, a horse called "Quicksilver" was brought into Winthrop, (Kennebec county,) where "Messenger" was also owned, and they were for some time rivals in the same town and neighborhood. "Quicksilver" was sired by "Dey of Algiers," a full-blood, imported gray Arabian; his dam was a full-blooded imported English mare. "Quicksilver" was, therefore, one-half Arabian and one-half English. He was raised by Gorham Parsons, of Cambridge, Massachusetts, and was sold in 1818—being then thirteen or fourteen years old—to James Pullen, of Winthrop. He was kept in this State six or seven years, and was then sold to Mr. Hamilton, of Cornway, New Hampshire, where he died, at the age of twenty-one or twenty-two years. His color was nearly a dark bay. The

* The renowned Trustee, who performed the unparalled feat of trotting twenty miles in 59 minutes 35½ seconds, was out of a mare—Fanny Pullen—that was raised in Maine. In 1849 Mac, a horse raised in Maine, won several matches against some of the most celebrated animals on the course. The dam of Mac was probably a descendant of Messenger, and his sire a Morgan, which has generally proved to be a most excellent cross. In 1851 Tacony, another Maine horse, beat War Eagle twice, though he was quite young, and in 1852 he won twelve times.

beauty and splendid appearance of the Quicksilvers was in strong contrast with the heavy and sedate appearance of the Messengers, and the former, in a business point of view, for a while superseded the latter in popularity; but as the Messenger colts came into service they began to be appreciated, and still bear the ascendency, while the Quicksilvers are nearly forgotten. The Quicksilvers, however, were handsome, docile, and sprightly, but generally lacked endurance, while the Messengers are of slow growth, heavy, often of bad disposition, but, when matured, of uncommon powers of endurance and excellent as roadsters. About 1830 a horse called the "Indian Chief" was brought to Augusta from Canada by T. W. Gale, esq. He was a small iron-gray horse, was a racker, and possessed great speed and bottom. He died, in 1844, at Vassalboro'. Some of his stock were great trotters, and were famous for their strength, energy, and powers of endurance. After the Messengers began to decrease, some descendants of the famous Morgan horse occasionally stood in different parts of Maine and left some good stock.

An importation of the Morgan Black Hawks was brought into this State a few years ago by Thomas L. Lang, of North Vassalboro'. It consisted of the following animals: Black Hawk, Telegraph, General Knox, Bucephalus, (bay stallion,) Taylor, (by Bolivar,) General Wayne, (bay stallion,) Trenton, (bay stallion.)

Mr. Lang's enterprise in introducing stock of so established a reputation into this State is deserving of the highest commendation; and under the management of so intelligent and skilful a breeder his establishment must exert a great influence in giving character and reputation to our already celebrated stock of horses. The Black Hawks combine good size, intelligence, symmetry, elegance of motion, and great speed, and much of the best stock of the original Black Hawk is to be found in Maine.

About 1850 or 1851 the full-blood Arabian horse "Imaum" was sent, as a present from the Sultan of Muscat, to Hon. David Pingree, of Salem, Massachusetts. "Imaum" was purchased, in 1854, by David Elder, of Gorham, Cumberland county, and kept for some years in different parts of Maine. "Tartar," sired by *Imaum,* is owned by J. S. Leavitt, of Salem, New England. This breed may be of much service to those desiring to raise elegant and splendid horses.

SHEEP.

The soil and climate of Maine are both well adapted to sheep husbandry, and within a few years this has become one of the leading pursuits of the farmers. The census of 1860 gives the number of sheep as 432,458, and the value of the wool purchased as $4,485,189.

Previous to the war of 1812 the sheep denominated as *natives* were described as tough, hardy sheep, capable of withstanding the cold, accommodating themselves to the varieties of pasturage and keep which the sandy plain or the rough hill-sides produced, their wool of medium quality, and their mutton of good flavor. The islands on the coast and the clearings on the seaboard were found, at an early day, to be excellent pasturage for them, and it is probable that many specimens of foreign breeds were early imported by vessels belonging in this State that had been on foreign voyages; but if imported at all it was not with any systematic plans, on the part of individuals, until after the above date. The war of 1812 interfered with the importation of fine woollen fabrics, and our people, being obliged to manufacture their fine cloths, of course turned their attention to producing wool of the same quality. At this time very fine wool commanded two dollars per pound. The first merinos introduced into Maine were from the flocks imported by Hon. William Jarvis, while he was United States consul in Spain. After the establishment of peace this

breed of sheep was much neglected on account of the direct importation of the finer qualities of woollen fabrics. About the year 1824, and subsequently, occurred the "Saxony speculation," which resulted in the importation of individuals of the Saxony breed by Judge Hayes, of York county, but the exact date we are unable to give. Although, by the mixture of the Saxony and the merino, the fleece became finer, it was diminished in weight, and the carcass and constitution became greatly deteriorated in strength and vigor. On account of the enfeeblement produced in the breeds of sheep by this crossing, many farmers began to raise other breeds which were more hardy and better fitted for the production of mutton, and others turned their attention to the introduction from abroad of coarser woolled and stronger constituted breeds. The Dishleys or Bakewell breed were first introduced into Maine by Dr. E. Holmes—from the flock of Stephen Williams, esq., of Northboro', Massachusetts, by whom they were imported—in 1828. A few years later others of the same breed were brought into this State by Charles Vaughan, esq., and Sanford Howard, of Hallowell. About 1835 these sheep were introduced into Winslow (Kennebec county) by R. W. Green, esq., whose name has been heretofore mentioned in connexion with the introduction of choice stock. The first Southdowns imported into Maine were obtained by Charles Vaughan, esq., of Hallowell, in the fall of 1834. During his lifetime this gentleman devoted considerable attention to breeding those sheep, and also imported many direct from England. He endeavored to combine the merino fleece with Dishley carcasses, but with indifferent success. In 1844 Dr. E. Holmes, of Winthrop, the Nestor of agricultural improvement in Maine, brought into this State, from the flock of Messrs. Corning and Sotham, of Albany, New York, a buck of the Cotswold breed—the first of this breed brought into Maine. Subsequent to this some of the Leicester breed were introduced from the British provinces, and also imported into York county by the Messrs. Bennett and others, of Parsonfield. About the same date (possibly as late as 1842) a number of gentlemen in Kennebec county purchased in Vermont a considerable number of the so-called "Vermont merinos," obtained from the flocks of Solomon Jewett, esq., and crossed them with their own flocks with undoubted advantage. After this, by the enterprise of distinguished breeders in New England, importations were made from France of two varieties of merinos, known as the "French" and "Silesian" merino.

Some thirty-five years ago there was a breed known as the "Otter sheep," which were then quite numerous. They are described as of medium size, short-legged, with a wide, heavy tail. They were unable to jump. Specimens of them have been seen in Kennebec county so late as 1837. Of late years our farmers have given considerable attention to sheep husbandry and to obtaining choice breeds from abroad.

In the "Agriculture of Maine" for 1855, p. 141, Dr. Holmes writes as follows: "The farmers of Maine have had heretofore, or have now, a sufficient number of varieties of sheep to meet the various wants and demands of the community, so that their success or failure in sheep husbandry must depend more upon their own judgment and prudence of management than upon a lack of different breeds of stock to operate upon." As to the best breed of sheep for our farmers to keep, much depends upon local circumstances and condition. In our own opinion, however, the Spanish merino, crossed with judicious care (added to general good management) upon our hardy natives, or some of the coarse-wooled breeds, forms the best breed of sheep for this State. The old English rule in feeding sheep was three pounds of hay per day to one hundred pounds of live weight. This, however, is more than the average weight our flocks consume, as most farmers regard two and a half pounds per day a sufficient amount. The season of feeding sheep during the winter is about one hundred

and fifty days. Experienced flock-masters prefer to have their lambs dropped about the last of April. It has been the custom to wash sheep before shearing, but it is gradually going out of practice.

SWINE.

In no branch of stock breeding has there been so little attention bestowed as in that of swine. Farmers were not formerly so particular to get good breeds of hogs as they have been during the last eight or ten years. Almost any animal that went on four legs, had a long nose, and could squeal well, was regarded good for pork-making purposes, and these were very numerous upon our farms until within a few years. Nearly all the different breeds of swine which have been propagated in different parts of the country, and have been celebrated for their many excellencies, have been tried in Maine. Some breeds have continued in favor longer than others, while some have been at once discarded, after a short trial. It is very readily admitted that no class of stock changes its characteristics so easily as swine; and from this fact, in connexion with another, that farmers have not been very careful in breeding them, we often hear the complaint that the breed has "run out," which means, in brief, that they have lost their original character and qualities, and have become degenerated, and are of less value. When farmers learn to exercise the same attention and care in breeding them that they do in other farm stock we may hope that the good qualities of a breed will be perpetuated, and their characteristics established and maintained through a series of years. The "Newbury White" was at one time a favorite breed among our farmers, and they were kept pure for some years, but they are now extinct. The "Mackay" and the "Bedford" came into repute after this, and continued in favor many years. After these came the Berkshire and its different varieties, followed by the Suffolk and grades, and also the Essex in limited numbers. The Chester Whites are now the most extensively raised of any breed, and they are highly prized. They fatten early, are cheaply kept, and are quiet and contented in their dispositions. Pork-making is not a prominent part of our farm operations; enough is raised by each farmer, in connexion with other branches of husbandry, for his own consumption, and but little is fattened for market. It is seldom that more than ten are kept by any one farmer. In 1860 the number of swine reported was 54,578.

POULTRY

does not enter so largely into our farm stock, so to speak, as to require a special notice. It may be remarked, however, as was truthfully said by an intelligent writer in a former report, that "poultry may be made a source of profit, exceeding any other investment on the farm, in proportion to the expense, and that a well-managed poultry yard will contribute its full share to the profits and comfort of the farmer, while, as a branch of rural economy, it is exceeded by no other in the interest and pleasure derived from it." And one source of the profit to be derived from them is their manure, which is usually an overlooked matter, but if carefully saved and properly managed, a flock of hens may be most advantageously kept simply for their manure. This will more than pay the cost and trouble of keeping.

THE DAIRY.

Notwithstanding the fact that Maine has a soil and climate and other natural advantages which render it especially adapted to grazing, yet there has not been so much attention paid to dairying, as a prominent branch of husbandry, as these circumstances would warrant. There is hardly a farmer but what makes a sufficient amount of butter and cheese for his own use, while many of them have a small surplus for sale; but there are few, as yet, who make the

manufacture of dairy products a leading pursuit. Hence it is a fact, no less remarkable than it is true, that cheese is an article of import to, rather than one of export from, the State. Heretofore it has been the practice of our farmers to raise beef cattle and beef for the eastern and for the Brighton markets, and this course of proceeding has turned their attention more to the rearing of cattle that would come to early maturity, readily fatten, and attain a large size, than to milch cows. Of late years—probably stimulated by the high premiums offered by agricultural societies for this class of stock—many of our stock-growing farmers have also given much attention to producing fancy matched cattle. The two courses of breeding have had the effect of developing other qualities in stock than their milking properties, and hence the race of deep milkers has become less prevalent than formerly. This has awakened the attention of some, and they are beginning to retrace their steps, and to breed for purposes of milk as well as for beef or looks.

Satisfied that Maine has every requisite, including good stock and good pastures, for becoming a dairy-producing State, and that it is a want of knowledge in regard to the correct principles of cheese and butter making which interferes with its becoming one of the foremost States in this particular, the secretary of our Board of Agriculture, S. L. Goodale, esq., has, the past season, investigated the matter, travelling over portions of this State and also through the dairy regions of New York and Connecticut, and, in his report for the present year, (1862,) gives a complete review of the whole subject of dairying, including the manufacture of cheese and butter, and giving, in a small compass, a more complete and practical view of the subject than can be found elsewhere, and which must be of incalculable benefit to the farmers of Maine in turning their attention to this neglected but most important matter.

The whole State, by the last census, produced 11,687,784 pounds of butter and 1,799,862 of cheese. That section of the State which may be called the most exclusively dairy region is along the valley of the Androscoggin; and according to the statistics which we have at hand, a larger amount of dairy products was made by the town of Jay, Franklin county, than by any other one town in the State; and this quantity is produced chiefly by small dairies. There are but two or three farmers in the town who keep above twenty cows, and the number is quite small of those who have a dozen cows each. The usual number kept is from four to six, and in some instances eight. To make up the amount of stock on farms of a hundred acres, there are usually a yoke of oxen, a pair of steers, one or two horses, and the remainder of the stock consists of sheep. By substituting cows in the place of oxen and other stock over and above what is necessary for doing the work of the farm, nearly double the number of cows could be kept; farmers would find it to their advantage to establish a cheese manufactory, and not only the product per cow, but the total amount of dairy products would be largely increased. So long as there is such a large foreign demand for cheese, and so long as Maine cannot produce enough for her own consumption, there is no fear that the business will be overdone, or that it will cease to become, what it is destined to be, one of the leading branches of our husbandry.

The plan which has recently been adopted in New York and some other States, of establishing a cheese manufactory in a neighborhood or district where from two to four hundred cows can be kept within a circuit of two or three miles, possesses many advantages; and we believe it can be introduced in many portions of Maine with decidedly favorable results. We have many sections where from two to three hundred cows can be kept within a radius of two miles, and in such places these cheese factories will ere long be established. In order to do it, however, farmers must abandon the practice of raising fancy stock, which, although a laudable and praiseworthy matter, yet we doubt if it

is one which has ever, in fact, paid. Some other things must also be attended to; among them, the improvement of our cows, and the introduction of such breeds as are known to be superior milkers; the renovation and improvement of our pastures; the use of better apparatus in cheese-making, and the employment of more knowledge and skill in its manufacture. When this is done we can produce an increased amount of cheese, of a better and uniform quality, and we can not only manufacture enough for our own consumption, but help to supply a foreign demand, and thereby become one of the most important dairy States in the Union. It will be done at no very distant day.

THE HAY CROP, GRASS LANDS, AND PASTURES.

The hay crop of Maine is our most important crop. Without it we could have "no cattle, no manure, no crop." It not only enters quite largely into our articles of export, but is an absolute necessity in providing for the wants of our domestic animals, which form so large a part of the economy of our farms, for they are obliged to be kept on dry forage, chiefly hay, one hundred days out of the year. In 1860 the census gave the hay crop as 975,716 tons, valued at $9,757,160. The hay crop in this State will average about one ton per acre. During the past ten years the total amount of the hay crop has largely increased, although it is doubted if the average amount per acre has advanced. The increase is due to the use of improved machines for securing the crop, particularly the mowing machine and horse-rakes. The former are very generally in use, and, in order for their complete and successful working, fields are cleared up and the surface made smooth. Thus, the use of this machine not only lessens the labor of harvesting the crop, but leads to an improved and more perfect system of husbandry; for, in the ratio that mowing lands are made smooth, and better fitted for the mowing machine to go over them, in the same proportion every other branch of farming is generally improved. But it is a question whether, by rendering our mowing lands smooth, and by cutting the grass close, we do not thereby injure the sward or roots of the grass by letting the water into the stem, which causes it to decay. The experience of some farmers is, that timothy, cut below the lowest joint, soon decays, because the water and snow are admitted, while, if cut above this joint, it is rarely injured during the winter. The truth of this would seem to be corroborated by observing farmers who have noticed the fact; and we are assured that the general practice of spring and autumn feeding of mowing lands is one of the most ruinous forms of farm practice that is tolerated among us. In many cases it becomes an almost absolute necessity, when pastures become short during the drouth of summer, to turn cattle into the mowing fields, but it should never be allowed. Better put cattle into the yards, and buy hay to keep them on, than to allow them the range of mowing fields after the crop has been taken off. Moderate feeding, however, where a second crop of grass or rowen is not cut, will affect no injury. By the improvement of low lands—usually denominated meadows with us—a large addition has been made to our surface of mowing grounds, and consequently to the annual yield. The growth of grass of these low meadows, naturally coarse and inferior, has by culture been brought to a fine quality, excellent for forage. The top-dressing of grass lands is beginning to be practiced, and is the true policy. By doing this they are kept in a good state, retain their original yield for a number of years, and are not required to be so often turned over. The autumn is the best time for performing this operation.

Many of the pastures, some of which have been used as such ever since they were originally cleared, begin to show signs of impaired fertility. Many of these are situated at some distance from the farmstead, are rocky, and otherways incapable of ploughing or culture. Something must be done to renovate them, or our farmers will be obliged to resort to new cleared lands—now in

wood lots—for pastures. The attention of farmers and agricultural societies, engaged the past number of years in the improvement of low meadows and swamps, can now be turned to the renovation of pastures, with a sure prospect of benefiting the agriculture of the State more by this method than by any other in the whole range of farm economy. The census of 1860 makes returns of 48,851 bushels of clover seed raised, and 6,307 of other grass seeds.

THE CEREALS.

INDIAN CORN

is second only in importance to the hay crop. It is grown, to a greater or less extent, throughout the entire State, although Mr. Goodale has said that he had observed there was a tract of land in Maine, both south and north of which corn could not be grown. At Phillips (Franklin county) corn is grown, but between Phillips and Rangley, a distance of only eighteen miles, the line of division shows itself. From this place it can be traced in a north-eastern direction, until it reaches the foot of Moose Head lake, where corn is not grown; but at Monson, (Piscataquis county,) a dozen miles southwest of Greenville, good corn is raised. Large crops of corn are also raised at Golden Ridge, in Aroostook county, although there are some localities in the county where it is not grown.

The culture of this crop has steadily increased. By the census of 1840 the yield of corn in Maine was put down at 950,528 bushels; for 1850 it was placed at 1,750,056; but the yield for 1860 is given as only 1,546,071. This falling off between 1850 and 1860 is probably due to the fact that in 1859—the year previous to the taking of the last census, and upon which estimates were based—was an extremely dry season throughout the State, and the yield of corn was below the average.

The stalks of Indian corn, especially the top part of the stalk, leaves, and husks, are highly prized as food for neat stock, and are carefully housed. They also make a good fodder for sheep, and, as a change from other food, are excellent for an occasional feed for horses. Now that public attention has been turned to new material for paper-making, it is possible that corn husks and stalks will form an important part of paper stock; and if so, a new demand will be created for this product, which will cause farmers to raise somewhat largely of it for this purpose.

The average yield of Indian corn, taking the State together, may be safely estimated at thirty bushels per acre. It is the common practice to grow beans and pumpkins in connexion with corn, but it is a plan which should be discarded.

BARLEY.

By the failure of the wheat crop farmers were led to the culture of barley as a sort of substitute therefor, and it has become an important crop. It is largely cultivated. The grain makes a very fair quality of family flour when bolted; and when ground for feeding purposes it is found to be a superior article for fattening hogs, and also for feeding horses, milch cows, and poultry. It is less liable to the attacks of insects than wheat, and is regarded as a safe crop. The average yield per acre is twenty-nine bushels.

WHEAT.

Formerly this was considered as the main crop throughout the State, but this was before the days of the rust and weevil. Farmers who did not grow wheat enough for their own consumption were looked upon as poor husbandmen; but when the crop began to be cut off they turned their labor into channels where a substitute for wheat, or a crop that could be exchanged therefor, could be produced. The law passed by the State, giving a bounty for the

encouragement of the growth of this crop, gave a strong impulse to its culture, but it did not prove permanent.

By census of 1840, wheat raised................	848,166 bushels.
By census of 1850, wheat raised................	296,259 bushels.
By census of 1860, wheat raised................	233,877 bushels.

New lands in the State continue to yield excellent crops of wheat. This is true throughout Aroostook county, and the newly-cleared sections, Franklin, Somerset, and other counties. During the past six years more attention has been given to the culture of wheat. The various varieties of spring wheat, *sown early*, give very favorable results. Winter wheat, grown to some extent a dozen years ago, has gone out of cultivation. To show what could be done in this State at growing spring wheat, with a season favorable to the crop, but unfavorable *for* the midge, we may remark that in 1860 reports from twelve, out of the sixteen counties in the State, gave the average yield of premium crops as *thirty-four* bushels per acre, the smallest yield in a county being *nineteen*, and the largest *fifty-one* bushels per acre.

OATS

are grown by nearly every farmer, but are considered an exhausting crop. As will be seen by the return of the census of 1860, they occupy a prominent place in our products, being set down at 2,988,939 bushels. If cut before the straw becomes too ripe it makes an excellent forage, and it is the practice of a large number of farmers to feed them out to sheep and cattle twice a week before they are threshed. The average yield per acre is twenty-five bushels.

RYE AND BUCKWHEAT

are secondary crops. The last census reports 123,290 bushels of the former, and 339,520 bushels of the latter.

FLAX

is but little cultivated. In 1860 there were 2,997 pounds of flax reported, and 489 bushels of flax-seed.

POTATOES.

Previous to the rot no crop was raised in greater abundance, or with more sure prospects of a good yield, by the farmers of this State, than potatoes. They were largely grown for the purpose of manufacturing starch, and also for shipping. But the prevalence of the rot has made them a rather uncertain crop, although the yield has largely increased during the past ten years.

By the census of 1850........................	3,436,040 bushels.
By the census of 1860........................	6,374,617 bushels.

This increase is probably the result, in part at least, of the introduction of new varieties which are not so readily affected by the rot. Much activity has been created in this particular within a few years—so much so that the old varieties are wholly superseded by other sorts. Immense quantities are annually shipped from Bangor, Belfast, Augusta, Portland, and other ports, in addition to those transported by railroad. The most popular market sorts are the Jackson's, and those commonly grown for the purpose of feeding out to stock are the Californians. On account of the greater ease with which they can be grown, they are more largely raised for feeding purposes than are other root crops. The average yield per acre is one hundred and fifty to two hundred bushels of the former and four hundred of the latter variety.

FRUIT CULTURE.

Although our soil and climate are both favorable to the culture of fruit, and although we have always had extensive orchards, it is only within a compara-

tively recent period that this branch of farm economy has been regarded with that importance which is now attached to it. The early settlers were not without their love for the orchard and its fruits; they brought a large amount of seeds, and numberless orchards were the result. The original fruit was, however, very inferior in quality, and was chiefly used in the making of cider, of which large quantities were annually consumed in farmers' families, and also sent to other markets at a remunerating price. "Among the great number of seedling trees thus grown," says Mr. Goodale, "are to be found some bearing fruit of high excellence, and well deserving extensive propagation." At a subsequent period, as the value of good fruit for the table began to be appreciated, and as choice varieties also found a ready market, the neglected orchards began to receive attention, and new ones were planted, and in a few years a great reform had been started in the culture of fruit. The value of the orchards throughout the State has been largely increased during the past ten or twelve years, and many farmers who before were negligent of their fruit trees, now make fruit-growing a leading branch of their business. The raising of choice varieties of apples, and the conversion of poor, inferior trees, to those producing excellent fruit, has also caused quite a reform in the manufacture of cider, as but a small amount of this is now made by our farmers. This change brings a greater profit to the farmer, and at less expense. An orchard of one hundred trees in a healthy state will produce, on an average, ten bushels of apples each. If these apples were of the quality made into cider, they would, with the labor of making, yield a barrel and a quarter of cider, valued at $2 50. If the fruit is of a good market variety for winter, the yield of the same trees would be worth, at the least calculation, $8.

As food for stock, apples are of about two-thirds the value of potatoes, though some farmers regard sweet apples as of equal worth with potatoes for feeding out to swine. They are more preferable for store hogs than for fattening ones, and to such are usually fed out uncooked.

Summer and fall varieties are raised for home markets; those for shipping are the more popular winter sorts. Among those recommended for general culture are the Baldwin, Roxbury Russet, Danvers Winter Sweet, Winthrop Greening, Rhode Island Greening, Ribstone Pippin, and Hubbardston Nonsuch. Mr. Goodale gives the following list of fruits as recommended for general cultivation in Maine:

Pears.—Doyenne d'Ete, Madaleine, Fulton, Belle Lucrative, Buffum, Flemish Beauty, McLaughlin, Vicar of Winkfield, Lawrence, Louise Bonne de Jersey.

Grapes.—Concord, Diana, Delaware, Clinton, Hartford Prolific, Rebecca.

Cherries.—American Amber, Black Eagle, Elton, Late Duke, May Duke.

Plums.—Imperial Gage, Lombard, Washington, McLaughlin, Greengage, Jefferson.

The small fruits are not so generally cultivated as they should be. One reason why they are neglected is, because strawberries, raspberries, blackberries, and the like, grow in spontaneous abundance and in direct succession, and the farmer can have them for the picking. Currants and gooseberries are found in most gardens, and return a good profit for the labor bestowed.

CRANBERRIES

have been cultivated to a small extent. In many places there are extensive bogs, which now yield but a limited profit, but which are natural for this fruit, and with but a small outlay could be made to pay a large return. In the town of Bradley (Penobscot county) is an extensive cranberry bog, which, in favorable years, yields a return of over one thousand dollars from this fruit. It consists of about seventy-five acres. Cranberries, in this market, are worth from two to three dollars per bushel, and within eight miles is an exten-

sive bog, which could be made to produce thousands of bushels annually. As it is now, what cranberries are raised, grow rather from neglect of care than from the receipt of it, although one farmer gathers about fifty bushels. The cost of preparing this and other bogs for the suitable culture of cranberries would, of course, vary with the situation; but it is safe to say that an outlay of two hundred dollars per acre would yield a return of from two to four hundred dollars' worth of fruit annually. There is no better plan of turning to utility our now uncultivated wastes than by stocking them with cranberries.

The orchard products of Maine, by census of 1860, were valued at $501,767.

MAPLE SUGAR AND SIRUP.

The maples which abound in our forests are annually made to contribute a share to the means of living, and how large a share will be seen from the fact that 306,742 pounds of maple sugar were made in 1860, no mention being given of the amount of sirup also manufactured; but inasmuch as this is the form in which the article is mainly consumed, the actual amount of sweetening manufactured will largely exceed the above estimated quantity.

The age of the trees is not material, provided they are of proper size, as it is evident that a very small tree would be more injured by the process of tapping than a larger one. Trees from ten inches to two or more feet in diameter are of the most suitable dimensions. Tapping should be done with care so as not to injure the tree, and it has been found by repeated experiments that a half-inch hole will yield as much sap as a larger one, the flow in all cases being in proportion to the depth of the hole. After the tree has done running, the hole should at once be stopped up. It has been estimated by some that each tree, taking the average together, will yield from five to six pounds of sugar during the season, and others consider two to three pounds as much as they will average. Probably the correct amount lies between these extremes. Formerly the vessels to receive the sap were troughs made of poplar or bass, and these were succeeded by sap-buckets, made somewhat in the form of pails, and unpainted. Tin vessels are light, easily kept clean, and are desirable on many accounts. They are used more extensively than heretofore. A good pan for boiling the sap is made of sheet-iron, by nailing the iron to plank, so that the iron shall form the bottom and ends and the plank the sides, the sheet-iron being secured to the plank by two rows of closely-driven nails. Eight feet long, four wide, and six inches deep, are good dimensions for this article, and if the arch or fire-place be made narrower than the pan, so it can be placed over it, it will be found a most useful arrangement for boiling the sap. In making good sirup the sap should be reduced to about one-thirtieth of its bulk, then strained through flannel, and left to cool and settle for about a day. After this, place it in the boiling pan, and add to every gallon one beaten egg and a gill of milk to clarify it, care being taken that it does not boil, till the scum has risen and been skimmed off. Then boil carefully until it will harden by placing it in cold water, when it should be poured into vessels and the cakes placed in a box to drain. To have the sugar perfectly white, lay a few thicknesses of flannel on the top of the cakes while they are draining; these absorb the coloring matter, and by having them washed daily with cold water the coloring matter will wash out.

Two men will take care of and do the work necessary to be done to three or four hundred trees. The work of manufacturing sugar and sirup takes place at a season of the year when other active farm labor has not been resumed, and thus affords a good opportunity for performing one of the pleasantest and most social parts of farm work.

FISH AND FISH-BREEDING.*

The fisheries of this State are among the oldest, as they have also been one of the most important interests of our citizens. No one who has sailed along our wide-spreading coast, or explored to any extent our numerous bays and creeks, but would be impressed with our unsurpassed facilities for marine fishing; and in travelling over the State the almost numberless rivers, lakes, ponds, and small streams, would also suggest the many advantageous localities for interior fisheries. These advantages were quickly discovered by the first settlers of Maine, and it is also probable that they were very strong inducements in drawing settlers to our coast and islands, notwithstanding the privations that attended the early settlements. Captain John Smith, in 1614, cruised along our coast with two vessels, returning to England in the fall of 1615, carrying thither, among other articles, 47,000 dry and cured fish, made at Monhegan island. From this time until 1626 the Plymouth colony carried on considerable trade with the settlements at Monhegan, Saco, and Damariscore, but during this year (1626) the trading-house at the former place was broken up and the goods transferred to Governor Bradford. In 1628 Governor Bradford, in behalf of the Plymouth colony, purchased a large tract of country on both sides of the Kennebec river, the grant to which gave them control of the fisheries and tráding sections thereon. As the population increased the business of fishing began to assume more system, and as it increased, step by step, and grew into a large and important trade, the maritime portions of our State also grew in population and strength correspondingly. Laws to regulate the fisheries and legislative action for their encouragement resulted not only in a great increase of the business, but also led to ship-building and a more extended commerce; it became the best practical school for seamen, who, at the breaking out of the revolution, formed the nucleus of our navy, which, though small, did effective service in our country's cause, and in the war of 1812 constituted a formidable rival to the strongest naval power then known.

To give a list of the fishes of Maine would take up more room than the interest in the subject would warrant, and we will therefore only mention the names of some of the most valuable found in this State, which are known to spawn in fresh water. They are: brook trout, *Salmo fontinalis;* lake trout, *Salmo confinis;* lake white fish, *Ceregonus albus;* pickerel, *Esox reticulatus;* Mascalonge, *Esox estor;* perch, *Perca flavescens;* striped bass, *Labrax lineatus;* shad, *Alosa præstabilis.*

Fish Breeding.—About five years ago Upham S. Treat, esq., and son, of Eastport, obtained exclusive control of three large ponds, situated about twenty miles from Eastport. These ponds each have outlets into the St. Croix river, the largest of them being three-fourths by one-half mile. The outlet is provided with a gate, by means of which it may be opened or closed as required, thus enabling the owners to retain the fish in the ponds, or allowing them to proceed to sea. They commenced the operations of fish-breeding in the spring of 1857, at which time a number of salmon, striped bass, shad, and alewives were placed in two of the ponds, the salmon being placed in the largest pond. The shad and alewives spawned about the first of June, and in about three weeks immense numbers of their young were seen. The gate at the outlet of the pond was then closed, and the growth of the young fish watched in the pond for three months, at the end of which time a portion of them were allowed to proceed down the river to the sea. The remainder of them were kept for two

* For many of the facts embraced in this part of my article I am largely indebted to the forthcoming report of Dr. E. Holmes, naturalist to the scientific survey of the State, whose report for 1862, on the "Ichthyology of Maine," forms a most valuable addition to popular knowledge, and gives, also, a complete view of the elementary principles of the science.

months longer, when they were dismissed into salt water. In the Agricultural report of the Patent Office for 1859 is an article on fish breeding, which also gives the further details of Mr. Treat's experiments, which we here introduce:

"The number of young produced by this first spawning was estimated at more than five millions. They had grown, when on their way to the sea, to the length of three to five inches. The salmon spawned in November, and the eggs were hatched in the spring after. Mr. Treat did not, however, succeed in detecting any of the young until the summer of 1859, when they were above a year old. They had then grown, he says, to the length of ten or twelve inches, and were changing from the trout-like appearance which characterizes them in their first year, and were taking on the silvery coat of the parent fish. As the lake is in some places forty feet in depth, not many of these young salmon were captured; but enough were secured to enable Mr. Treat to identify them. The old salmon still appear to be in good condition and are frequently observed. They have been in the lake two winters and two summers. Whether they continue to breed is not, as yet, known. The young salmon were also allowed to follow their natural instincts and to proceed to the sea at the proper season. Mr. Treat confidently expects the return of his fish—such of them as survive the dangers of the seas—as soon as they become capable of reproducing their species and feel the impulse of that instinct which induces them to seek the fresh water for the purpose of depositing their spawn."

Wishing to obtain from the Messrs. Treat some additional facts in regard to their success in breeding migratory fish, we addressed a note of inquiry to them, and were favored with the following reply:

"Dear Sir: As to how far we have succeeded in breeding and raising migratory fish, we beg to reply that we have had good success in raising the alewife by planting the old in new homes, in waters hitherto unknown to these kinds of fish. We planted the old in two small lakes or ponds, the stream from each emptying into the St. Croix river, about two miles apart, and had the same good success on both streams. We learned that it required four years for the young to mature and return to breed in the waters in which they were bred, and that the young do not return to the waters until they mature, but remain in salt water. It requires eighteen days for the ova to hatch, and as soon as out of the egg they swim near the shore in shallow water. Their natural habits are to stop in fresh water about sixty days. At that time they attain to about three inches in length, and make their way to salt water. The instinct of these fishes is very remarkable. They know their homes, and will not mix with neighboring streams only two miles apart, although the fish are of the same species and their habits are the same. We have no doubt but that the waters could be made as productive as the land by planting migratory fish. Our experiments on other kinds of fish are not yet matured."

Abijah Crosby, esq., of Benton, has been engaged during the past three or four years in stocking some of the ponds in Somerset and Kennebec counties with migratory fish, and with the most gratifying prospects of success.

It is but a few years ago, comparatively, that fresh water fish in abundance were caught in our tributary rivers; now the fish seem to have deserted these ponds and rivers altogether. The immediate causes of this are the building of dams across tributary streams, by means of which the fish are prevented from ascending to their proper spawning places; the pollution of waters by the erection of mills and factories, (by the saw-dust, and the refuse of chemical ingredients used in the different process of manufacturing,) and the disturbance of the waters of larger rivers by steamboats. In some instances the legislature has caused an erection of fish-ways in dams for the passage of migratory fish.

MARINE MANURES.

Our sea-coast furnishes an important source of fertilization. Seaweed is used in large quantities by coast farmers, and with most satisfactory results. It is usually carted in the winter months and piled in yards and sheds, and mixed with other manures. It rapidly decomposes, and in drying largely diminishes in bulk. It is used as a top dressing to grass lands with undoubted efficacy, acting in part as a mulch; it is also used as a compost. While seaweed is used with such good results near the coast, it has also been proved beneficial on lands twenty miles in the interior. It would not be impossible to suppose that seaweed, dried and pressed into bales, may hereafter become not only a reliable means of manuring land in the interior of the State, but an item of no small importance in a business point of view. On the flats adjoining

some of our bays and creeks a deposit known as *muscle-bed* is found in large quantities, which proves a highly valuable and durable fertilizer on clayey loams near the sea-coast. It is much too heavy for profitable transportation far into the interior. In some instances the deposits of this material cannot be reached by teams in summer because of the softness of the mud, and it is the practice of farmers to haul it in winter, when the ice is firm enough to bear up teams. At low tide holes are cut in the ice, and the muscle-bed is easily placed upon the sleds.

Something is done in the business of manufacturing guano from fish and fish offal. Mr. Fowler, of Lubec, formerly manufactured a small amount each year, by drying the fish after they are pressed, and grinding them, afterwards mixing gypsum with it. Mr. C. G. Allen, of Camden, is also engaged in its manufacture. The article which he puts up is prepared from "pogy chum" by simply drying it in the sun, adding, when packed in barrels, one peck of gypsum per barrel of 150 pounds. It sells for about $1 50 or $2 per barrel. At Eastport Messrs. Treat & Son are largely engaged in the manufacture of fish guano. They have found it more profitable to press the fish, chiefly herring, for their oil than to smoke or salt them for the market. The remains of the fish, after extracting the oil, are prepared for guano by drying and grinding. It is manufactured under a patent held or claimed by the Quinnipiac Company, of Connecticut, which patent consists simply of "drying by solar heat upon an elevated platform;" and the principal amount manufactured is shipped to that State, where it has given the best satisfaction as a fertilizer. During the past season about three hundred tons of this fish guano have been manufactured by the Messrs. Treat, the price being $20 per ton, exclusive of bags, shipping, &c. These trials have demonstrated the fact that a portable, inoffensive, and efficient manure can be manufactured from fish and fish offal with no great outlay for expensive machinery, and at a price amply remunerative to manufacturer and purchaser. This will hereafter become a larger business than it is at present.

ASSOCIATED EFFORT AND LEGISLATIVE ACTION FOR THE ENCOURAGEMENT OF AGRICULTURE.

Dr. Benjamin Vaughan, LL.D., and his brother, Charles Vaughan, of Hallowell, Kennebec county, were the first gentlemen to act in the work of agricultural improvement in this State, and their labors in this direction gave an impulse to others, and the interest awakened by their efforts have continued until the present day.

In 1787 some farmers residing on the Kennebec river organized themselves together, under the name of the "Kennebec Agricultural Society," the objects of which were mutual improvement in agriculture, and mutual aid by the importation of stock, implements, trees, seeds, books, &c. "The leading and animating spirits in this movement were the Messrs. Vaughan." In 1791–'92 an importation of cattle, tools, trees, seeds, &c., was made by the Messrs. Vaughan, it being their first importation. During the year 1807 the "Kennebec Agricultural Society" was incorporated by the legislature of Massachusetts; and though it held no "cattle shows" or exhibitions for some time, it had frequent meetings for the reading of papers contributed by its members, and for discussion and consultation. The "Agricultural Repository," issued under direction of the old Massachusetts society, contains many articles and papers of great value from this society, which show the ability and industry of its members. The contributions of Dr. Benjamin Vaughan bear marks of deep study and originality. In 1818, by the earnest efforts of the Messrs. Vaughan, Messrs. Wood, of Winthrop, and other friends of agriculture, the "Maine Agricultural Society" was incorporated. This society received no aid from the State, and its only funds were from the entry fees of members. In

1820 it had accumulated a sufficient amount to warrant an exhibition and the paying of premiums, and a show was held at Hallowell. In 1821 another exhibition was held in the same place, but for want of funds and the means of transportation only a small section of the State was represented in exhibition, and the action of the society was discontinued, and county shows created in its stead by the members. In 1818 some of the farmers of Winthrop, headed by the Messrs. Wood, formed the "Winthrop Agricultural Society," which soon became a very useful and active association, spread into the towns, held annual shows, &c. It continued in force until about 1831–'32, when it merged into a county society, and then petitioned the legislature for a charter and funds. Through the labors of Major Elijah Wood, though not without much opposition and modifications of plans, a "law relating to agricultural societies" was formed and passed in 1832. This law gave from the State treasury a sum of money annually to each society, as large as the society would raise from subscription or otherwise, the fourth section of the act reading as follows:

"Every society availing itself of the benefit of this chapter shall, at their discretion, annually and publicly, offer premiums for introducing or improving any breed of useful cattle or animals, or any tools or implements of husbandry or manufacture; introducing, raising, or preserving any valuable trees, shrubs, or plants, or in any way encouraging or advancing any of the branches or departments of agriculture, horticulture, or manufactures. And no such society, by their by-laws, shall confine such premiums to their own members, but shall bestow them on any person residing within the limits of such society who shall produce the best specimens."

During the session of the legislature which passed this law three societies besides the Kennebec were incorporated.

In the fall of 1832 it was thought expedient to have an organ by which the farmers of Maine could advocate their interest, and through which they could communicate with each other. In 1833 Dr. E. Holmes, of Winthrop, commenced the "Kennebec Farmer," the title of which was soon changed to the "Maine Farmer," which it now retains. Dr. Holmes has continued the senior editor of this paper for over thirty years.

There are now, besides the State society, twenty-five county societies in flourishing condition.

The legislature of 1852 established a board of agriculture; but the original bill, in the course of its passage through this honorable body, was so altered and amended as to be of no particular benefit. Although it gave the board authority for assembling each year, it furnished no compensation for the labor of its members, and was therefore of no working force. It was the form without the substance. The board held annual sessions until 1855, when the deficiences of the law under which it was established had become fully apparent, and the members were most zealous in having them remedied. By their exertions a law incorporating and endowing the State Agricultural Society was passed, with an executive committee to transact its business, which committee were to have the powers and duties proper to a board of agriculture, and at the same time more fully prescribe the duties and powers of the local agricultural societies. In 1857 a law amendatory to an act establishing the board was passed by the legislature. By this law each agricultural and horticultural society was entitled to elect one member to represent them in the board, their term to continue for three years. This is the act now in force, with the exception that each county only is entitled to a delegate, and where there is more than one society in a county the societies must meet in caucus to choose each delegate.

In 1836 a resolve passed the legislature authorizing a geological survey of the State, and Dr. Charles T. Jackson, of Boston, was engaged as chief geologist and director of the survey. The labors of this gentleman and his assistants were continued until 1838, when the usual annual appropriation bill failed

to pass, and it was suspended. This was owing to the heavy expenses and liabilities incurred by the State in a local matter, in addition to the general pecuniary pressure felt by the State as well as her citizens. In 1855 an appropriation was made for "the continuation of the geological and agricultural survey of the State;" but the requirements of the act, if carried out, would involve an expense greater than the sum appropriated, and of course all action in the matter was deferred.

The legislature, at the session in 1861, passed resolves authorizing a "scientific survey of the State." The organized corps of the survey consisted of Dr. Ezekiel Holmes, naturalist and chief of survey, and Prof. Charles H. Hitchcock, geologist, with an able staff of assistants in the different departments. This survey has been in operation two years; and were it not for the unhappy condition of our country, the good which it has accomplished and opportunities for manufactures and industrial pursuits which it has pointed out would at once be taken advantage of by our citizens. The return of more favored times will give an opportunity for developing them.

Besides the legislation above mentioned, there have been at different times special enactments granting bounties to encourage the growth of various products, wheat, corn, &c. Production was doubtless largely affected by these bounties, but the increase was found temporary and evanescent. The policy was always deemed somewhat questionable.*

I cannot close without referring more particularly to the labors of the Secretary of the Board of Agriculture, and the good which has followed therefrom.

Previous to the reorganization of the board in 1856, the annual publications of the State relating to agriculture were occupied with reprints of the doings of the county societies; were often little else than a record of premiums given, and contained nothing of general or special interest, and but a limited demand was found for them. But during the past six years the demand for the Secretary's report has been constantly increasing, while the several editions have also been largely increased in numbers. This demand testifies to the appreciation in which they are held in our own State. Abroad they have been sought for from every quarter, largely quoted from, and pronounced "models of excellence in the department they represent."

The labors of the secretary during the year 1861 were directed to the investigation of resources in the matter of marine manures, and specially the manufacture of "fish guano," which will, sooner or later, result in the establishment of a new branch of industry, and the saving of an untold wealth of fertilization to the whole State. His labors during the present year have been in connexion with dairying, of which we have already spoken

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FLORIDA.

SOIL, CLIMATE, AND PRODUCTIONS.

BY L. D. STICKNEY.

Florida, with an area of 60,000 square miles, has a population of only 140,425—77,747 white and 62,677 black. That division of the State known as East Florida, being all the territory south and east of the Suwannee river, and embracing the entire peninsula between 25° and 31° of latitude, by reason of its fine climate, productive soil, extensive forests of valuable timber, numer-

* Agriculture of Maine, 1856, p. 21.

ous rivers affording excellent navigation, a thousand miles of sea-coast indented with bays and sounds, and the whole interior of the country diversified with beautiful lakes and ponds abounding in fish and fowl of various kinds, and of the most delicious flavor, can support a population of one hundred to the square mile with one-half the labor required to live in the eastern or middle States.

A large portion of the country is covered with pine forests, the trees standing at a considerable distance apart, without undergrowth; grass and flowers spread luxuriantly over the surface of the earth during the whole year, and, being unusually intersected with streams of pure water, cattle find excellent range. The pine land, though termed "barrens," is, in many instances, not less productive than the numerous live-oak and other hard-timbered hummocks of the richest soil, so finely adapted to the culture of sugar, rice, cotton, corn, tobacco, indigo, and fruits. Limestone or marl underlies, pretty generally, the peninsula; springs are numerous, pure, and cool. Allachua, an interior county, is curiously diversified with savannas, lakes, ridges of hummock, and plains of pine barren. The soil, in one part, is covered with a rich black loam; in another, with sand mixed with limestone, sandstone, or flint. In some places, for a great extent, not even a pebble can be found. The savannas or prairies, covered with tall grass, are often fifteen miles in extent. Allachua and several adjacent counties are particularly rich in vegetable productions; the surface lies in graceful undulations, and in its natural state is covered with oak, pine, magnolia, orange, and madeira trees, cane-brakes, grape, and other vines.

Although East Florida embraces six degrees of latitude, no very great difference of temperature is felt between the north and the south. Mr. John Lee Williams, who wrote a valuable history of Florida, says that during a residence of eighteen years in the State, the greatest heat has been 96° Fahrenheit; but only three or four times has it risen to that height during that long period. Generally 85° Fahrenheit is the maximum of summer heat, and 45° Fahrenheit the minimum of cold in winter. The mean temperature of St. Augustine is about 65° Fahrenheit. The peninsula projects so far to the east as to divide the trade-wind; one portion of it passes up the coast, and forms the charming sea-breeze which makes the climate, even in summer, so agreeable and refreshing. The meteorological statistics published by Surgeon General Lawson, United States army, as derived from diaries kept at all the military posts, show that the coast of East Florida, in equableness of climate, surpasses Italy.

It produces the long staple or Sea Island cotton of commerce, over any part of the peninsula, with a productiveness surpassing the coasts of South Carolina and Georgia, to which this staple has been hitherto limited, and can supply any quantity of it to which the consumption will ever reach. It produces sugar, with great advantage over Louisiana or Texas, having a superior climate for the cane; and has sugar lands enough to supply the consumption of the United States.

It is a great mistake to suppose that sugar cannot be made to advantage without the investment of large capital. The cane produced on less than ten acres of ground is usually ground in a wooden mill, which does not cost one hundred dollars, (generally the work of the farmer himself,) while the juice is boiled in the common utensils of his kitchen, or, at best, as the New England farmer manufactures his maple sugar. The yield is usually greater, in proportion to the stock worked, than where the machinery has cost ten or fifteen thousand dollars. Cane is cultivated with more ease than corn, not requiring so much hoeing. From midsummer to the time of harvesting the hands may be employed in other business; and even at the time of taking off the crop no great increase of hands is required, as in Louisiana or Texas, where frost prevails. One hand can cultivate six acres with the hoe, or ten to twelve with the aid of a horse and plough. At the same time he can raise other crops suf-

ficient to subsist himself and family. Twelve hundred pounds of sugar to the acre is an average yield, though four thousand pounds have been produced. The molasses is always expected to pay the expense of manufacturing.

Cuba tobacco is, next to sugar, most in favor with small planters. The flavor is thought to be not inferior to the production of the famous district of Vuelt de Abajo, in the island of Cuba, when grown on old land well manured. The sandy soil near the sea-coast is well adapted to this production. Ordinary seasons give three good cuttings from the same stalks. Seven hundred pounds is an average crop to the acre, which, when Virginia or Kentucky tobacco would not bring more than six cents, readily sold in market at from fifty to seventy-five cents per pound. The same tobacco would now command two dollars.

Rice is a valuable crop when fresh water can be had to flow the ground during the dry season. The upland rice, however, may be cultivated without water. Pine lands, upon which cattle have been herded for a few weeks, have often produced sixty bushels of rough rice to an acre. With one month's labor, one hand, with a horse and plough, can cultivate ten acres of rice.

During the British occupation of the country indigo was the principal staple of the Florida planters. None brought a higher price in the London market, except that from Caracas, which owed its preference to superior manufacture. Except sugar, this is the most certain crop in Florida. It is indigenous to the country, abounding in the pine barrens, and even in the old fields cultivated by the British nearly a century ago, in spite of time and the constant cultivation of other products.

The climate is the best in the world for the production of silk. Every species of mulberry grows as far south as the 27th degree of latitude.

The Cochineal insect is a native of Florida. The Nopal, on which the insect feeds, is also a native plant.

Corn is the most important article of food in a southern climate. To the negro it is indispensable, and many of the white inhabitants prefer corn bread to that made of wheat. Although Florida lies south of the corn-growing belt, very good crops are nevertheless produced in the State. Forty bushels to the acre are often gathered on the best land, but from ten to fifteen bushels is the average crop. Guinea corn, Otaheite corn, and millet succeed very well. The latter, in particular, is a useful crop.

The sweet potato and the yam find in the Florida pine land their natural soil. Four hundred bushels are often produced to the acre. The common potato produces a good crop if planted in the winter. Cabbages planted in November grow to a great size. Pumpkins, squashes, and melons are produced with indifferent culture, and are of delicious flavor. Peas, beans, and, indeed, all the garden vegetables of the temperate or the torrid zone succeed perfectly well in Florida.

Fruits are abundant and in great variety. The apple does not succeed, but the quince bears in the northern part. Figs are abundant and of a rich flavor. Peaches, nectarines, and apricots succeed perfectly. The Florida orange is larger and more aromatic than the Cuban. The pomegranate, the guava, citron, "forbidden fruit," or shaddock, lemons, and limes are produced with ease, and everywhere abundantly. The cocoanut flourishes south of the 27th degree of latitude. Wild plants and grapes are in great variety. Some of the cultivated species of the latter produce two crops annually. The pineapple and banana are cultivated with success. The olive and the tamarind are growing in many places. Arrow-root is a profitable crop. The pistache was greatly cultivated by the Seminoles. The vine produces a large crop on sandy land. It is a native of Spain, whence it has been transferred to the gardens of Italy. In Florida it is perfectly naturalized. Grasses are numerous and nutritious. There are few spots of uncultivated land not covered with

grass. Deer, as well as cattle, in vast herds, fatten on the wild grasses of the forests and prairies.

The late Bernard M. Byrne, surgeon United States army, was stationed many years both in Texas and Florida. Devoting himself to an attentive study of the soils and productions of the two States, respectively, his views, modified by practical experience in cultivation, will be an excellent guide to persons emigrating to Florida. While there is in every State and Territory of the Union a large proportion of barren and poor lands, the ratio of these lands differs greatly in different States. Florida has a due proportion of *poor* lands; but, compared with other States, the ratio of her barren and worthless lands is very small. With the exception of the everglades, covering only a portion of Dade county, and a few irreclaimable cypress swamps of no great extent, there is but a small portion of Florida which cannot be made tributary to some agricultural purpose under her tropical climate. She has no mountain wastes, no barren prairies, and there are but few acres of uncultivated lands in the whole State that are not covered with grass or valuable timber.

As the opinion has been very widely disseminated that Florida is composed of swamps and everglades, or barren, sandy plains, a brief description of her lands will be interesting to agriculturists generally, and particularly to those who desire to produce in our own almost everything which our comfort or our luxury draws from other countries.

Pine lands (yellow pine) form the basis of Florida. These lands are usually divided into three classes, denoting first, second, and third rate pine lands, according to the field-notes of the original surveys of the country.

That which is denominated "*first*-rate pine lands," in Florida, has nothing analogous to it in any of the other States. Its surface is covered for several inches deep with a dark vegetable mould, beneath which, to the depth of several feet, is a chocolate-colored sandy loam, mixed, for the most part, with limestone pebbles, and resting on a substratum of marl, clay, or limestone rock. The fertility and durability of this description of land may be estimated from the well-known fact that it has, on the upper Suwannee and in several other districts, yielded, during fourteen years of successive cultivation, without the aid of manure, four hundred pounds of *Sea Island cotton* to the acre. These lands are still as productive as ever, so that the limit of their durability is yet unknown.

The "second-rate pine lands," which form the largest proportion of Florida, are all productive, and can, by a proper system of cultivation, be rendered much more valuable than the best lands in Texas. These lands afford fine natural pasturage; they are heavily timbered with the best species of yellow pine, and are for the most part high, rolling, healthy, and well-watered. They are generally based upon clay, marl, or limestone. They will produce for several years without the aid of manure, and when "cow-penned" they will yield twelve hundred pounds of the best quality of sugar to the acre, or about three hundred pounds of Sea Island cotton; or they will, when properly cultivated, produce the finest quality of Cuba tobacco, oranges, lemons, limes, and various other tropical productions, which must, in many instances, render them more valuable than the best "bottom" lands in more northern States.

Even pine lands of the "third rate," or most inferior class, are by no means worthless, under the climate of Florida. This class may be divided into two orders: the one comprising high, rolling, sandy districts, which are sparsely covered with a stunted growth of "black jack" and pine; the other embracing low, flat, swampy regions, which are frequently studded with "bay galls," and are occasionally inundated, but which are covered with luxuriant vegetation, and very generally with valuable timber. The former of these, it is now ascertained, are, owing to their calcareous quality, well adapted for the growth of Sisal hemp, which is a valuable tropical production. It is scarcely necessary

to add that the second order of "third-rate pine lands," as herein described, is far from being worthless. These lands afford a most excellent range for cattle, besides being valuable for the timber and naval stores which they produce.

There is one general feature in the topography of Florida, which no other country in the United States possesses, and which affords great security to the health of its inhabitants. It is this: that the pine lands which form the basis of the country, and which are almost universally healthy, are nearly everywhere studded, at intervals of a few miles, with hummock lands of the richest quality. These hummocks are not, as is generally supposed, low, wet lands; on the contrary, they are high, dry, and undulating, and never require either ditching or draining. They vary in extent from twenty acres to twenty thousand acres. Hence the inhabitants have it everywhere in their power to select *residences* in the pine lands, at such convenient distances from the hummocks as will enable them to cultivate the latter without endangering their health, if it should so happen that any of the hummocks prove to be less healthy than the pine woods.

Experience in Florida has satisfactorily shown that residences only half a mile distant from cultivated hummocks are entirely exempt from malarial disease, and that the negroes who cultivate those hummocks, and retire at night to pine land residences, maintain perfect health. Indeed, it is found that residences in the hummocks themselves are generally perfectly healthy a few years after they have been cleared. Newly cleared lands are generally attended with the development of more or less malaria. In Florida the diseases which result from such clearings are usually of the mildest type, (simple intermittent fever,) while in nearly all the other southern States they are most frequently of a severe grade of bilious fever.

A general interspersion of rich hummocks, surrounded by high, dry, rolling, healthy pine woods, is a topographical feature peculiar to Florida, and forms, in this respect, a striking contrast with Louisiana, Texas, and Mississippi, whose sugar and cotton lands are generally surrounded by vast alluvial regions subject to frequent inundations, so that it is impossible to obtain a healthy residence within many miles of them.

The lands in Florida which are, *par excellence*, denominated "rich lands," are, first, the "swamp lands;" second, the "low hummock lands;" third, the "high hummocks;" and fourth, the "first-rate pine, oak, and hickory lands."

The swamp lands are unquestionably the most durably rich lands in the country. They are the most recently formed lands, and are still annually receiving additions to their surface. They are intrinsically the most valuable lands in Florida, being as fertile in the beginning as the hummocks, and more durable. They occupy natural depressions or basins, which have been gradually filled up by deposits of vegetable *debris*, &c., washed in from the adjacent higher lands. Ditching is indispensable to their successful cultivation. Properly prepared, their inexhaustible fertility sustains a succession of the most exhausting crops with astonishing vigor. The greatest yield of sugar ever realized in Florida was produced on this description of land, viz: four hogsheads, of 1,200 pounds each, per acre. This was raised on Dummitt's plantation, near New Smyrna. Sugar-cane is well known to be one of the most exhausting crops, and is usually grown without rest or rotation.

Low hummocks, which, from the fact of their participating of the nature of hummocks and swamps, are sometimes termed *swammocks*, are not inferior to swamp lands in fertility, but perhaps are not quite as durable. They are always level, or nearly so, and have a soil of greater tenacity than that of the high hummocks. Some ditching is necessary in most of them. The soil is always deep, and extremely well adapted to the growth of cane.

High hummocks are the lands in greatest repute in Florida. These lands differ from low hummocks, in occupying higher ground, and in generally pre-

senting an undulating surface. They are formed of a fine vegetable mould, mixed with a sandy loam in many places two feet deep, and resting, in most cases, on a substratum of marl, clay, or limestone. This soil scarcely ever suffers from too much wet; nor does a drought affect it in the same degree as other lands. High hummock lands produce all the crops of the country in an eminent degree. Their extraordinary fertility and productiveness may be estimated by the fact that in several well-known instances in Marion county, (Clinch's, McIntosh's, &c.,) three hogsheads of sugar per acre have been made on this description of land, after it had been in cultivation six years in successive crops of corn, without the aid of manure.

The "first-rate pine, oak, and hickory lands" are found in pretty extensive tracts in many parts of the State. From the fact that these lands can be cleared at much less expense than the swamp and hummock lands, they have heretofore been preferred by the small planters, and have proved remarkably productive.

There are, besides the lands already noticed, extensive tracts of *savanna lands,* which approximate in character, texture of soil, and period and mode of formation, to the swamp lands, differing only in being destitute of timber. Some of these lands, however, are extremely poor.

From the landing of the Spanish adventurer, Pamphillo de Narvaez, in 1528, to the Jeff. Davis rebellion, in 1861, slavery has brooded like night over this region, so appropriately called "the land of flowers." Whether prompted by Spanish cupidity for gold, or the Anglo-Saxon's ambition for empire in a textile plant, three centuries of violence and injustice have not suffered a single generation to pass away undisturbed by internal dissensions or hostile invasions. Velasquez, Narvaez, and De Soto, in the first half of the 16th century; the religious crusades, projected by Philip II of Spain and Charles IX of France, in the latter part of that century; the relentless wars between Catholic and Huguenot, and of Christian against aborigines, are an unbroken history of bloody persecutions. Menendez massacres a French colony, and erects a monument of his atrocity near the spot, with this inscription: "Not as Frenchmen, but as heretics." De Gourgas, to avenge the horrid butchery of his countrymen, sails from France with an expedition which lands in Florida, and, in turn, attacks the Spanish in their stronghold. Scarcely a man escapes death. Gourgas ordered the Spaniards to be hung on the spot where he found the skeletons of the former colonists, and affixed this label: "Not as Spaniards, but as murderers." Later, the English colonies in Carolina and Georgia renewed the contest against the Spanish, and made frequent incursions into Florida, until the acquisition of the territory in 1763. Great improvements were made by the English during the twenty years they held possession of the country. They encouraged agriculture in the east and west by offering bounties on indigo, and for the increase of naval stores. The country became cultivated to a great extent, and more sugar and rum was manufactured in East Florida than at any period since. The natives, generally, retired from the towns and commenced raising horses and cattle in the deep forests. The country was extensive and full of game; the climate mild, producing many fruits. All these circumstances tended to invite the neighboring Indians to collect and settle, especially around those pleasant prairies and old fields abounding in peach and persimmon orchards and wild orange groves. These grew to be a nation, under their old name—"Seminoles," or wanderers. The recession of the country to Spain, in 1783, operated as a blight on the whole land. The English population removed *en masse,* as the Spanish had done before, abandoning their plantations, gardens, villages, and towns. A military government succeeded, followed by a general neglect of agriculture; fields were suffered to grow up with briers, and sugar-houses to rot down. In 1812 the Georgians again carried war into Florida, and compelled the Spanish commandant of

Fernandina to surrender. Seven years later Spain ceded East and West Florida and the adjacent islands to the United States. The country settled rapidly, under the new government, and the cultivation of sugar-cane, cotton, and tobacco was widely extended, until checked by the Seminole war, which lasted twenty years, and nearly devastated the country. Surpassing all the enormities and crimes of her past history is the great slaveholders' rebellion which now convulses the nation.

With capabilities and resources possessed by no other State, the longest settled, and, since admitted to the Union, patronized by the government more lavishly than any of her sister States, Florida is not at the present moment so great and prosperous as when ceded by Great Britain to Spain, eighty years ago. She is even below what she was when northern arms delivered her from the Seminole Indians. Permanent peace and security, and an uninterrupted prosperity which shall grow with her growth, can only be hoped for under a free constitution. With that, her deserted fields and waste places will bring rich returns to industry, and be the homes of a happy people.

THE WHEAT PLANT.

BY LEWIS BOLLMAN, BLOOMINGTON, INDIANA.

SYNOPSIS.

I. The extent of the wheat region of the United States, and the motives inducing to its development.
   1. The limitation given to it by Mr. Klippart and others examined.
   2. The influence of railroads on wheat production.
   3. The present and future markets for American wheat.
   4. The manufacturing, commercial, and carrying business dependent on the wheat crop.

II. The best modes of growing and harvesting wheat.
   1. The nature of the wheat plant.
      a. Whether created as it now is.
      b. Organic, inorganic, and proximate analysis of the grain.
      c. Germination of the seed and growth of the plant.
      d. Diseases, enemies, and casualties, and their remedies.
   2. The best soils for wheat production.
      a. Natural soils.
      b. Artificial soils, by deep ploughing, drainage, and use of barnyard, green, and mineral manures.
   3. Cultivation.
      a. Implements—the plough, the harrow, and the drill.
      b. The times and modes of using these, and, herein, of the uses and kinds of the fallow, harrowing, and rolling.
      c. Selecting seed wheat.
      d. Time and manner of sowing it; the use of the drill.
      e. Spring harrowing.
   4. Harvesting.
      a. The proper time for cutting.

b. The best mode of cutting.
c. Binding, shocking, and stacking.
d. Threshing and cleaning.
e. The proper place to stack the straw, and how it should be disposed of. *Analysis of the grain and straw.*

THE WHEAT PLANT.

There is no history which takes us beyond the cultivation of the wheat plant. Some believe it was created as it now is, and was from the beginning the every-day food of man in the form of bread, from the curse pronounced against Adam, "in the sweat of thy face shalt thou eat bread." In his lamentation for Tyrus, the prophet Ezekiel says: "Judah and the land of Israel they were thy merchants; they traded in thy market wheat of Minnith." From this we see how ancient were the production and commerce in wheat, and the history of all nations shows it to have been the chief product from which bread was made. It has, consequently, assumed an importance above any other cereal.

When America was discovered it was not found on this continent. It was, however, soon brought here, and a slave of Cortez finding a few grains in some rice, sent from Spain, carefully preserved and planted them, and from these, it is believed, the wheats of Mexico and the Northern Pacific have been derived. It was introduced into the Elizabeth islands of Massachusetts in 1602, and in 1611 into Virginia. In 1718 it was brought into the valley of the Mississippi, and in 1746 flour was first shipped from the Wabash river to New Orleans. This was the commencement of a trade that has become a part of the history of the west, and rendered the free navigation of the Mississippi so essential to its prosperity that no political changes or necessities will ever be permitted to close or obstruct it.

Although the wheat crop of the United States is much less in number of bushels than the corn crop—the one being, according to the census report of 1860, 170,176,027 bushels, and the other 827,694,528 bushels—yet the market value of it is not much less than that of corn. In the commercial world it is the great ruling product, regulating, as Mr. Webster said, the exchanges of Europe and America.

A crop of such magnitude should receive greater consideration than has yet been given to it in the agricultural reports of the general government. I will endeavor to discharge this duty by considering it under two general divisions:
1. *The extent of the capabilities of the United States in the production of wheat.*
2. Its proper cultivation.

I. THE WHEAT REGION OF THE UNITED STATES.

1. THE LIMITATION GIVEN TO IT BY JOHN H. KLIPPART AND OTHERS EXAMINED.

What is the extent of the wheat region of the United States, is a question that has been considered and differently answered. Politicians who know nothing of agriculture have often asserted that the United States can feed the whole world—an assertion too absurd to be further noticed. But, on the other hand, the wheat region has been narrowed to limits entirely too contracted.

"The natural and permanent wheat region," says Mr. Klippart in his essay on the growth, &c., of the wheat plant, "lies between latitude 33° and 43° north. This wheat region embraces Ohio, the south parts of Michigan and New York, the whole of Pennsylvania, Maryland. Virginia, and Delaware, and in these States we find where is raised, or has been, the greatest wheat production. Ohio stands at the head of all the wheat-growing States in the aggregate of her production. Her crop in 1850 was twenty-eight millions of bushels, being nearly sixteen and a half bushels to each inhabitant.

"Thus the reports of the geological survey of Ohio, show the soil to be clayey, clayey loam, and clayey subsoil, and it produces 16½ bushels to each inhabitant, while Indiana,

with a richer soil, produces only $8\frac{1}{2}$ bushels, and Illinois, with a still richer soil, produces only $7\frac{1}{2}$ bushels to each inhabitant. Virginia, Maryland, and Delaware, as well as New York, were formerly great wheat-producing sections. But many parts of New York that formerly produced twenty-five bushels to the acre, do not now average over five bushels, and many parts of Maryland, Virginia, and Delaware, that formerly produced abundantly, will not now pay the cost of cultivation. *Exhaustion* is written all over them in language too plain to be misunderstood."

This opinion, if correct, in the course of that rapidly increasing home demand, arising from the progress of manufactures, and from that unfortunate exhaustion which Mr. Klippart justly condemns, (for it pervades too many portions of the new States as well as of the old,) would soon limit the capability of the United States to the supply of its own wants. But he is mistaken in his information of the general character of the soils of Indiana and Illinois, and of the adaptability of the richer portions to wheat production. The alluvial lands of the Wabash, White, and White Water rivers, in Indiana, and of many of their tributaries, are so very rich as to give rise to the idea abroad that the entire soil of this State is of a deep, black, loamy, sandy, and carbonaceous nature, rendering it too light for profitable wheat cultivation. This is an error. Between these alluvial districts the land generally is a rolling clay limestone soil, heavy and tenacious enough to prevent the roots of the wheat from being laid bare by freezing or drought. This is especially true of the south half of the State, and the adaptability of the rich soils of the north half may be seen from the following counties and their wheat product in 1858:

Counties.	Bushels of wheat.
Boone	194,512
Carroll	256,668
Cass	295,685
Elkhart	346,495
Howard	163,782
Kosciusko	306,277
Laporte	291,103
Miami	366,198
Steuben	273,810
Wabash	288,491

Several of these counties are new, and our counties generally are small. The entire crop of Indiana in that year was 16,090,007 bushels. But the census report of 1860 most completely disproves the assumption that the wheat region of the United States is limited by the boundaries Mr. Klippart would affix to it. It shows that the very soil which scientific men have condemned as unsuitable for wheat production, if not the best, is, at least, as well adapted to it as the heavier clay soils. This is seen in the following returns of the census of that year:

STATES.	1850.	1860.
	Bushels.	*Bushels.*
Michigan	4,925,889	8,313,185
Wisconsin	4,286,131	15,812,625
Iowa	1,530,581	8,433,205
Illinois	9,414,575	24,159,500
Indiana	6,214,458	15,219,120
Ohio*	14,487,351	14,532,570

* The crop of 1859 does not fairly represent Ohio production. The freeze of the 4th of June of that year made it a short one. Its average product is about 20,000,000 bushels.

Here we see that Illinois, with such a large portion of light carbonaceous soil, produced nearly ten millions of bushels of wheat more than Ohio, and increased its wheat product in these ten years 157 per centum, whilst Ohio has scarcely made any increase at all. Indiana, with an area of over six thousand square miles less than Ohio, raised more wheat, and increased its product in the last decade 145 per centum. Some writers also limit the wheat region to ten degrees of latitude. The census returns do not less pointedly refute this theoretical view. I need refer but to two States to show this.

STATES.	1850.	1860.
	Bushels.	*Bushels.*
Minnesota	1,401	2,195,812
Texas	41,729	1,464,273

These are the extreme States of the Mississippi valley, but are too new to exhibit their true value as wheat-producing States. On the Pacific coast we have California and Oregon, whose wheats are unsurpassed in excellence, and on the Atlantic the old State of Maryland, with "many parts" exhausted, having added 50 per centum to its wheat product between 1850 and 1860. Take out from the vast region lying between these five States the desert portion of the Rocky Mountains, and we have before us the wheat region of the United States.

It may not be without utility to inquire into the causes of the error into which Mr. Klippart and others had fallen. These are two: first, overlooking the adaptability of spring wheat to these lighter soils; and second, being misled by the small wheat product of the northwestern States, as exhibited in the census return of 1850.

It is true that winter wheat in portions of Michigan, Illinois, Wisconsin, and Iowa is an uncertain crop. It needs a heavy soil that cannot be crumbled into dust by severe freezing and then blown from the roots of the wheat plant by the strong winds of the prairies when the snow is light. But spring wheat in these portions gives a remunerating crop, and hence the great progress made by these States in their wheat product.

The low wheat production of the northwestern States, Ohio excepted, prior to 1850, is attributable entirely to their want of market facilities. A residence of thirty-three years in Indiana has familiarized me with the agricultural condition of the west. Prior to 1850 our wheat market of the county of my residence was at Louisville, accessible only during the Indian summer weather of the fall. With his wagon and team the farmer carried his surplus wheat crop, at one load, ninety miles, at a season when the waters of the Ohio river were too low to permit shipments, and when the yellow fever at New Orleans had stopped all commerce at that city. The markets were without the least animation, and the usual Louisville prices were from 40 to 50 cents a bushel. If our farmers returned home with as much sugar and coffee as would supply the economical wants of their families, they accomplished all that they expected by their surplus crops of wheat. Of what avail would a larger crop have been? They therefore directed their attention to the raising of corn, feeding it to hogs and cattle, which carried themselves to market, even when corn production was ruinous to their soils.

2. THE INFLUENCE OF RAILROADS ON WHEAT PRODUCING.

From what I have just stated it will be seen that a wheat region without transportation facilities is unavailable. It is necessary, then, to examine what

these are to show the *capability* of the wheat region of the United States; its extent only has as yet been shown.

Up to 1850 no one dreamed of the network of railroads which has since been spread over the northwestern States. A single road connecting the eastern States with St. Louis was all that the most sanguine hoped to see; but events in England made railroad iron there cheap and in great abundance, and with its characteristic energy the west was not slow to avail itself of the inducements proffered.

We are told at first the earth was without form and void, and that darkness dwelt on the face of the deep until there was light, and the waters separated from the land, when the earth was clothed in green, and every tree yielded its fruit. Our railroads were almost as miraculous in their influence over all the region of the northwest: the wilderness became a fruitful field, and untravelled wastes bloomed and budded as a garden. They opened the interior of its States to commercial connexion with all sections of the country at all times of the year. There was breathed into the farmer a new spirit, and he became another being. The contrast between his present and former condition is seen in every page of the census report of 1860. So vitally is it connected with the production of the northwest for the present and the future, more especially with the wheat crop, that a table of these roads becomes an essential part of an essay on wheat.

STATES.	1850.		1860.	
	Miles.	Cost.	Miles.	Cost.
Michigan	342	$8,945,749	799⅓	$31,012,399
Wisconsin	20	612,382	922½	33,555,606
Iowa	....	....	679¾	19,494,633
Illinois	110½	1,440,507	2,867.90	104,944,561
Indiana	228	3,380,533	2,125.90	70,295,148
Ohio	575¼	10,684,400	2,999½	111,896,351

In this vast increase of railroads during the last decade we see the cause of that corresponding increase of the wheat crop of the northwest. With the progress of railroads in Missouri we see the wheat crop increasing also, and the available wheat region of the United States is bounded only by the limits of railroad enterprise. The projected railroad to the Pacific will be a spinal column to all that unsettled region stretching out, on either hand, a wide country of prosperity and beauty.

3. THE PRESENT AND FUTURE MARKET FOR AMERICAN WHEAT.

But a third thing is essential to the development of the resources of a wheat region—a demand for its product. I proceed, then, to examine what that demand is and will be, as far as the American farmer is interested, and in so doing shall inquire, *first,* what the home market is and will be; *second,* what the foreign market is and will probably be for the future.

1. *The present and future home market.*—Although the increase of wheat has been seventy per centum during the last decennial year, yet at no previous period have prices been so satisfactory to the producer. Fluctuations there have been, as there always will be, in all markets for all productions; but the average price in this period exceeds the average price of any other like period. The cause of this is to be found in a better home and foreign demand. Had the home demand but increased only with the increase of population, the average price would have been much less; but it has much exceeded this, and the cause

for it is explained, by the census report of 1860, in the great increase of manufacturing labor.

The value of our manufactures in 1850 was $1,019,106,616, and in 1860 about $1,900,000,000—an increase of eighty-six per centum, whilst the increase of population in the same period was thirty-five per centum. But this amount, great as it is, does not include mechanical productions below the annual value of five hundred dollars, which are not taken in the census, nor of the mechanical pursuits not classed in manufactures. The Superintendent of the Census, Mr. Kennedy, says: "It is safe to assume that *one third* of the whole population is supported, directly and indirectly, by manufacturing industry."

These results, so highly encouraging to the wheat producer, are not found in the eastern and middle States only, but in the west, too—thus bringing the consumer closer to the producer, as the latter advances further west. The statistics of Ohio show an increase in its agricultural productions, and in its mining, manufacturing, and mechanical industry, and its commerce and navigation, as follows:

Corn crop, 18 per centum; wheat, (about,) 20 per centum; horses, 63 per centum; cattle, 40 per centum; hogs, 15 per centum; mining, 300 per centum; manufactures and mechanic industry, 90 per centum; tonnage, 260 per centum.

These statistics exhibit the general tendency of the older agricultural States to increase those pursuits which create consumers of agricultural products, whilst those regarded as manufacturing have made a rapid progress in all branches of manufactures and mechanical employments. Thus these pursuits aid and sustain each other, and call into existence another class of laborers profitable to both—those engaged in the commerce, navigation, and transportation which the interchange of their commodities create. The wheat product may be taken as an illustration of these influences of manufacturing industry. It amounted, as already stated, to more than one hundred and seventy millions of bushels in 1860. The value of flour and meal manufactured was $223,144,369, nearly all of which was consumed in the home market; the export being but $16,360,582.

The industrial products of the farmer and manufacturer will continue to find a remunerative market in their mutual consumption, until the desolation of wars, by diverting their industry to unprofitable labor, will paralyze the prosperity of all.

2. *The present and future foreign market.*—No part of my subject has occasioned me as much difficulty as this. We have no statistical bureau in our general government to collect the recent and reliable statistics of Europe, nor do the governments of that country collect statistics of their productions as the United States does in its census. In the article on wheat-growing in Prussia, published by Mr. Judd, our minister at Berlin, but evidently prepared by an intelligent Prussian, this remark is made: "Official statistical reports of the whole quantity of wheat produced annually in Prussia do not exist at all, because all experiments to fix the quantity have remained without result." If this is so in the small, enlightened, and highly agricultural kingdom of Prussia, how uncertain must be the estimate of Russian grain production, so large in territory, and with a population so heterogeneous in races, language, customs, and laws and how unreliable must be the accounts of German grain production, with its numerous principalities! Still, we have a good deal of statistical information of grain production and consumption, sufficiently accurate, for my present purpose, to present a general estimate of the demand on our country for its wheat from the deficits of European nations.

Great Britain is the only country that has a permanent deficit in breadstuffs. It 1792 it imported 209,225 bushels of grain, and exported 2,802,594. This was the last year when its exports exceeded its imports. From that time until about 1846, on account of the vast increase of its manufacturing industry, sus-

taining a dense population, the deficit of breadstuffs has ranged from five millions of bushels to twenty-eight millions. In 1848, a year of unusual scarcity, on account of the potato rot of 1847, the imports of wheat were 24,793,564 bushels, and of flour equivalent to 17,721,362 bushels, making, together, 42,514,926 bushels. In 1839 about twenty-eight millions of bushels of grain were imported by Great Britain, of which about twenty-four millions were wheat, nearly all of which was furnished by European nations, as follows:

	Quarters.
Prussia	740, 203
Germany	409, 729
Russia	371, 693
Italy	335, 612
France	278, 182
Denmark	196, 730
Holland	116, 480
	2, 148, 629

or 20,053,787 American bushels, the English quarter being equal to nine and one-third bushels of sixty pounds.

The English government, alarmed at the growing wants of the country in breadstuffs, caused inquiries to be made by its consuls in the different grain ports of Europe to ascertain, as far as possible, the supplies which might be relied upon from European nations, and how far these supplies could be increased. The following table embodies the facts elicited by these inquiries:

Answers from—	Quantity that might be expected.	
St. Petersburg	192, 500	quarters.
Odessa	150, 000	"
Leiban	30, 000	"
Warsaw	300, 000	"
Stockholm	1, 000	"
Dantzic	315, 000	"
Konigsberg	65, 000	"
Stettin	250, 000	"
Memel	6, 000	"
Elsinore	538, 000	"
Palermo	200, 000	"
	2, 222, 500	"

or 20,743,333 bushels. The answers show that no material increase above this amount could be expected. These places are the principal shipping ports of grain in Russia, Austria, Poland, Sweden, Prussia, Denmark, Germany, and Italy.

France may be regarded as capable of supplying only its own consumption of breadstuffs. In 1850 and in 1851 it exported, the first of these years, about fourteen millions of dollars' worth, and the second about sixteen millions, whilst in 1856 and 1857 its imports were, in both years, 49,677,535 bushels of grain.

The annual production of wheat is placed at about 191,000,000 of bushels, leaving but eleven millions of bushels for seed.

Prussia, eminent for its agriculture, furnished to England, as is seen, in 1839, nearly double the amount of any other nation; yet of itself it possesses no ability beyond the supply of its own wants. In the article of Mr. Judd referred to, the annual wheat product of Prussia is stated to be 20,000,000 bushels, and the consumption per head 105 pounds. These, I presume, are Prussian

bushels and pounds; if so, this amount is equal to about 35,333,000 American bushels of production, and two and a quarter bushels of consumption for each person. The population of Prussia is, in round numbers, seventeen millions—making its consumption 38,250,000 bushels, being more than its production. Whatever supplies are received by England and other nations from Prussia must be the production of Russia and Poland. The article of Mr. Judd states that Prussia imported from these countries, in 1858, 2,169,000 bushels, and in 1859, 1,280,000.

The wheat product of Austria is stated to be 94,824,681 bushels, with a population of nearly 40,000,000. If its consumption is no more to each inhabitant than in Prussia—two and a quarter bushels—the entire consumption would be 90,000,000 of bushels, leaving but 4,824,081 bushels for seed. So far, then, as it affords supplies to Great Britain, these must be drawn from Russia and Poland. Germany and Italy may be regarded as occupying a similar position to Prussia and Austria—unable, from their own wheat product, to export to other nations. And here I may remark, that nearly all these countries consume potatoes in large quantities, so that, from the uncertainty of this product, unusual demands at home will often arise for wheat, thus rendering a dependence upon them by Great Britain too uncertain to be relied upon. Besides this, the wants of these nations are constantly increasing beyond their agricultural supplies. We have seen how rapidly the manufacturing, mining, and transportation interests are increasing in our own country beyond the per centum increase of agricultural industry. A like change marks the progress of nearly every European nation, each one striving to establish its independence in manufactured articles. Hence their ability, either of themselves or through Russia, to supply England is growing weaker, as is seen in the largely-increased exports of the breadstuffs of the United States to Great Britain. In 1850 our exports of wheat and its products were $8,074,438, but they regularly increased to 1860, when they were $20,004,951. At some periods in this decade they were much higher from unusual causes, as in 1854, on account of the Russian war, when they reached $40,616,956; in 1857, from short crops, when our exports were $48,687,169, and in 1861, from the same cause, when they reached $63,389,181.

Russia, alone, produces an amount of breadstuffs far exceeding its own wants. Its Poland possessions are the best wheat regions in Europe, and the extent of production is limited only by unskilful husbandry and the want of railways.

Russia is wanting in sea-coast; and, although its rivers are connected by canals, yet the heavy transportation of wheat and flour, as we have seen in our western States, demand such near markets as a net-work of railroads only can give. Still Russia can export grain largely, as is seen when the general short crop in Europe in 1847, from the general rot of the potato, created an extraordinary demand on its capabilities. In that year it exported of wheat and its equivalent of flour 70,502,572 bushels. But its distance from the markets of Great Britain and France, and the want of a large commercial intercourse with these nations, will limit its exports of grain to Austria, Prussia, and Germany, whilst the United States will supply France and Great Britain. To do this under the constantly increasing home demand will insure favorable markets generally to the wheat producer of the United States, and, at times, demand every surplus bushel at the highest prices. He has, therefore, everything essential to success—a vast wheat region, the best means of transportation, and a great and increasing home and foreign market.

The manufacturing, commercial, and carrying business dependent on the wheat crop.—Having considered the first general division of my subject, I wish, before passing to the second, to glance at the home interests dependent on the wheat crop.

I have already stated the value of the flour and meal manufactured in the United States to be $223,144,369, being an increase of $87,246,563 upon that of 1850. The meal is not separated from the flour, but it constitutes but a small portion of this large sum. This manufacture is, therefore, about an eighth part of the entire manufactures of our country. The value of agricultural implements is $17,802,510, one-third of which may be credited to wheat production. Ploughs, drills, and reapers make up the chief part of this amount, and these are indispensable to it. Wagons are constantly used in stacking the sheaves and hauling the grain to market, whilst drays and other vehicles are necessary in the transit of wheat to the mills and of the flour returned from them. The barrels and bags used are items of no small importance, and the building of the mills and the construction of their machinery give employment to the carpenter and millwright.

A product so universally and so largely consumed as flour, creates a commercial interest that cannot now be traced out, for the space it would require cannot be given. From the mill it passes through the hands of the wholesale dealer, the exporter, the retailer; is taken on every railroad, on every steamboat and ship, as the distribution carries it from the granaries of the west to the consumers in the east and south, and in foreign countries, until the household bakes it into bread; and the city bakers again send it into every district of our country as crackers and biscuit; and all the labor bestowed on it is constantly adding to its value; and the farmer (that it first benefits) asks in return the various manufactures wrought by the skill of the laborer at the looms.

I have mentioned the great influence exercised over the wheat production of the west by the railways passing through it. It followed that this increased production gave large employment, in return, to these and other roads. The freights of wheat and flour make a leading item of railroad, steamboat, canal, and ship transportation, calling into active employment the builders of ships, and cars, and locomotives, and increasing largely the number of persons necessary to the working of them. All this varied labor is for the good of all, for it sustains the existence of all unattended with any incidental evil. The sweat of the brow, decreed as a puninshment to our first parents, has been sanctified to us in these diversified pursuits which the necessity of bread has created. Strike out of existence the wheat product of our country, and when and how could the vast void be filled? And in view of the magnitude of its importance as a food essential to all at all times, to the poor and the rich, in health or in sickness, to each one, no matter what occupation or condition of life, how God-like in its simplicity and necessity is the prayer taught us by our Saviour, "Give us this day our daily bread."

The best modes of growing wheat.—The second general division of this essay relates to the proper cultivation of the wheat plant, and under it I will consider, *first,* the nature of the plant; *second,* the soil best adapted to it; *third,* its cultivation; *fourth,* harvesting it.

The nature of the wheat plant.—Whether the wheat plant has always been as we now find it, or had its origin in an inferior plant, is a question not well settled. A French gardener, M. Fabre, sowed the seeds of a coarse grass, named by botanists *ægilops,* in the fall of 1839, which ripened in July following. Its seeds he sowed in the fall of 1840, and continued sowing the seeds every year until in 1845, when the plants then raised were regarded by all who examined them as genuine wheat plants. Its changes from the coarse grass were gradual, at first producing few seeds, but which increased in number as its resemblance to a wheat plant became stronger. This experiment would indicate that the wheat plant is the result of cultivation.

On the other hand, its deterioration, when uncultivated, should be rapid until it resumed the characteristics of a coarse grass. This does not seem to be the case, for the wheat plant was found growing wild in California and Oregon,

over a large extent of territory, and under circumstances that precluded the supposition that it had been cultivated by the Indians. Here it exhibited itself as a genuine and thrifty wheat plant. Whether this is the result of a climate and soil highly favorable to it, or because it was created at first a wheat plant, can be determined only by further experiments. Until these are made, the presumption must be that our cereals, like our grasses, first grew with all those distinctive differences they now present.

The numerous varieties of the wheat plant undoubtedly had a common origin, for it is much modified by soil, climate, and cultivation. In color there are the white, yellow, and red varieties; but in the United States commerce recognizes but two—the red and white. They also differ in some having smooth heads, while others are bearded; and some being sown in the fall are called winter wheats, while others are sown in the spring, and known as spring wheats. But all these differences may be changed, the one to the other, by soil, climate, and time of sowing. Winter tropical wheats cannot endure the cold of the temperate regions, but may be acclimated to them. The influence of climate alone is seen in the marked differences between wheats raised in the belt of the trade-winds, such as the Chilian, Australian, and Californian, and those of rainy regions, as of the United States. Rains seem to thicken and darken the skin or bran. Hence the fine wheats of our climate cannot be successfully grown in a different climate, but will deteriorate to the general standard of excellence of the country to which they have been taken; so, also, in early or late maturity. An early wheat in the hot climate of America will lengthen its season in such a moist and cool climate as that of England. Hence our constant failures to improve our varieties of wheat by importing seed from other countries. After being acclimated they present no important differences from our own. The same has been the experience of English farmers when importing the fine varieties grown in Australia. The only successful course to improvement lies in the production of new home varieties by hybridization. The varieties of maize can be easily produced from this aptitude to mix. So strong is this, that to be kept pure, different kinds should not be planted in adjoining fields. But wheats do not so easily hybridize. It is said that they may be sown alongside of each other, and will not mix, because of the strong tendency of the pistil of one plant to reject the pollen of another, preferring that of its own plant, seemingly insensible to the fructifying power of a different variety when its own pollen is also received. I doubt, however, the correctness of this statement to this extent; but that the intermixture is much less easily effected than with maize is doubtless true. That wheats rapidly run out is certain; the common complaints fully show this; but this is from unsuitable soil and cultivation. The most flinty grains will become soft and chaffy when grown in a soil too poor to produce good wheat. If such product is sown, the deterioration is so rapid that the crop becomes unremunerative, and the farmer seeks new kinds. From this we learn the lesson that our seed wheats should be grown in a well-manured and well-cultivated soil, rather than rely on new varieties. Such course will enable us to avoid small and badly matured grains which so rapidly deteriorate a crop, as will be shown when speaking of the germination of the seed.

The nature of a plant, as to its elements, can be known from analysis only. As these elements are derived from the soil, modified into different forms and prospects by the peculiar vital forces of each plant, the analysis of the plant and the soil become of the highest utility to the farmer, for they teach him what soils are naturally adapted, or must be made so artificially, for the production of certain plants.

There are *three* analyses of every plant; *first*, the ash analysis, being that part of it which remains after burning. This shows the mineral element of the plant; it is usually known as the *inorganic* analysis; *second*, the *organic*

analysis, or the atmospheric, being those elements of the plant which it derives directly or indirectly from the atmosphere; *third*, as these atmospheric elements are compound bodies, they may, by analysis, be reduced to their elements, and such analysis is called proximate.

Analysis of wheat.—When 100 pounds of wheat are burned, about two pounds of ashes remain, showing the relative proportions of the ash and atmospheric elements. The analysis of the ashes is as follows:

Potash	29.97	per cent.
Soda	3.90	"
Magnesia	12.30	"
Lime	3.40	"
Phosphoric acid	46.00	"
Sulphuric acid	0.33	"
Silica	3.35	"
Peroxide of iron	0.79	"
Chloride of sodium	0.09	"
	100.	

When the grain of wheat is analyzed before burning, it is found to contain the following atmospheric elements:

Water	14.83
Gluten	19.64
Albumen	0.95
Starch	45.99
Gum	1.52
Sugar	1.50
Oil	0.87
Vegetable fibre	12.34

As these are compound bodies, they may be further analyzed, and they are composed of the following elements:

	Gluten.	Albumen.	Starch.	Gum.	Sugar.	Vegetable fibre.
Carbon	53.27	53.74	42.80	42.63	36.1	53.23
Hydrogen	7.17	7.11	6.35	6.33	7.0	7.01
Nitrogen	15.94	15.66	....	....	....	....
Oxygen	....	....	50.85	50.94	56.9	16.41
Sulphur	23.62	23.50	....	....	....	23.35
Phosphorus	....	....	....	....	....	....

These analyses show the reason why wheat flour has been through all ages, and so universally, used for making bread. It contains a large proportion of gluten, which gives it tenacity when made into dough, and by which it is made light with yeast. Maize has but 3.68 of gluten, and hence it cannot be made light as wheat dough. Hard, flinty wheat contains about 2.50 more of gluten than soft wheats; hence their higher commercial value. But gluten is of the highest value as food, because it forms muscle or flesh, whilst oils, sugar, gum, and starch form fat, and sustain the animal heat of the body, through the breathing of the lungs. Not unaptly, therefore, is wheat bread called the staff of life, for it imparts strength to the muscles.

Germination of the seed and growth of the plant.—The nature of the wheat plant may be seen also in the germination of its seed and in the growth of the plant. Both present many interesting as well as important practical matters to the agriculturist. The grain is composed of the husk or bran, enclosing starch and the germ of the future plant. The starch is provided for the growth of the germ until by its roots and leaves it can support itself from the soil and the atmosphere. Three things are essential to awaken the dormant life of the germ into active existence—air, heat, and moisture. When the grain is deposited in the soil it absorbs the moisture and heat of the soil; it swells, absorbs oxygen from the air, and soon the germ pushes through the covering of bran, and puts forth its tap root, which descends deeper than the others into the soil, and its stem, which shoots above it. In so doing it lives and grows from the starch of the grain. But this starch cannot be dissolved but by the moisture drawn into the grain, and it is only through the moisture that the food of the plant is taken into the roots; for the germ has its roots. This starch was formed from the sugar of the plant on which the grain grew, and as sugar is soluble in water, the first thing that nature does is to reconvert the starch into sugar. Immediately around the germ, (through the agency of the heat, moisture, and oxygen of the air,) is formed a substance to which chemists have given the name of *diastase.* It changes the starch into sugar; but how it does it, or how itself is formed, yet remains hidden in the invisible operations of nature. We have in the familiar operations of malting barley an illustration of the action of diastase. After the barley is soaked in water and put in heaps it heats very rapidly and begins to sprout. It is then dried, and has a very sweet taste, for the diastase has converted a large portion of the starch into sugar. The same work of diastase is seen by those who use barley, wheat, or rye as a substitute for coffee. These are soaked until they sprout, and are then dried and parched. When thus malted they are found to be very sweet, because the starch has been changed to sugar. But if the wheat is put into the soil so deeply that no air can get to it, then this diastase cannot be formed, and the starch is not changed to sugar. The germ has nothing to subsist upon, and does not grow. Or if an insufficient amount of air reaches it, it will sprout, but the growth of the germ will be spindling and weak, for but a small portion of the starch is changed to sugar. If the seed is sown in a tenacious clay soil, and is followed by a heavy compacting rain, the same result will follow, for the clay is pressed so closely around the seed that either no air or an insufficient portion only reaches the grain. If the grain becomes moist under such conditions, it speedily rots. In September, 1861, I ploughed in a small portion of wheat in a corn-field, but was driven out of the field early in the morning by a heavy, beating rain, and the rows thus ploughed in never showed the tenth part of the seed I sowed on them. Two years ago I lost my entire potato crop from the heaviest rain I have ever seen flooding the ground, on the day after the potatoes were planted, compacting it harder than before it was broken up, which was rendered more impervious to the air by a sharp drought. The destruction of seed from these causes is much more frequent than is supposed, and hence a common expression of the farmer: "Well, I put the seed there, but I do not know what has become of it."

Moisture is as essential as air. It not unfrequently happens that after wheat is sown, and has imbibed moisture enough from the soil to enable it to begin to sprout, that the dry weather of our Indian summer sets in and dries the top soil so much that the grains near the surface are completely dried. Its growth must cease until rain falls, but in the mean time the sugar formed from the starch attracts the red ant, which eats out the germ and the sugar in the grain, leaving the unchanged starch. But I will recur to these things when speaking of the drill.

The *growth* of the plant is not less instructive. It forms three kinds of

roots: first, the *primary*, or tap root; second, the secondary, or side roots; and third, the surface roots. The tap root is that first formed by the germ of the seed. Its principal purpose in the wheat plant, as in trees, seems to be to fix the plant firmly in the soil, and to sustain it until the side roots are thrown out. Its utility in the first growth of the plant is great, as is seen in the sorghum; for the plant is dependent on it until the side or secondary roots are formed. As the seed of the sorghum is small, it has but little starch to sustain it until the side roots are thrown out; hence its slow, weak growth at this period. This is very much the case with the wheat plant. On this account the soil around the tap root should be of excellent quality, and reduced to the finest state of pulverization.

The *secondary* roots, in which I include the spring roots of the tillers, are thrown out each side of the tap root where it comes out from the seed. These are the chief roots of the plant upon which its growth depends, and they divide, and subdivide, and multiply, until they form that network of roots seen in a vigorous wheat plant. Upon these roots the tilling of the wheat plant relies, and hence, according to their vigor, do we find the multiplied stems by the tillering process. The *surface* roots are not important unless the seed has been deposited too deeply, when a bulb is formed on the stem at the surface of the ground, from which these roots proceed. Many farmers believe that it is unimportant as to the depth of the sowing, supposing that the principal roots of the plant are formed at the surface of the ground; but this is an error, as I will more fully show when noticing the proper mode of sowing the seed.

Diseases, enemies, and casualties.—There is none of our cereals so liable to injuries from diseases, enemies, and casualties, as the wheat plant. It has the "gauntlet" to run from the time the seed is sown until the sheaves are in the stack. No matter how promising the crop may be at any stage of its growth, the farmer considers everything as doubtful until it is cut. The causes creating this uncertainty merit a thorough investigation to determine how far they are a part of the nature of the plant, or to what extent they may be avoided by a more careful cultivation. I will consider the most destructive of these diseases. The rust, or mildew, and the smut, are the most fatal to the wheat crop of the United States.

1. *The Mildew, or the Rust, and its remedies.*—The oldest of our histories, the Bible, frequently alludes to it as common among the Jews, and represented it as one of the punishments inflicted on that disobedient people. They were warned that disobedience would be followed "with blasting and with mildew;" and when thus punished, the prophet Haggai says: "I smote you with blasting, and with mildew, and with hail, in all the labors of your hands; yet ye turned not to me, saith the Lord." The Hebrew name for the rust, *yarcoon*, meaning a yellow color caused by moisture, is indicative of the cause and appearance of the disease then as we find them now. The Grecian and Roman writers have transmitted to us like names and causes. The Greeks called it *erusitee*, and the Romans *rubigo*. Ovid, describing the rubigalia, a religious festival established by one of the earliest rulers of Rome, makes the priest say, "If the sun fervently heats the moist stalks, then, O dread goddess, is the opportunity for thy dread wrath. Be merciful, I pray, and withhold thy rusting hands from the crops." In all times, and among every civilized people, this disease existed, and a moist stalk heated by a hot sun is the cause of it; hence heavy dews, precipitated by clear, cool nights, succeeded by a hot sun during the day, soon develop the disease now as it did in the most ancient periods. It was not until the microscope was invented that the true nature of the disease was known. There is a species of plant which lives on the sap of other plants, called parasite. The rust and smut are plants of this character. The microscope shows the fact that rust is a perfectly-formed plant, having roots, stems, and branches, and producing seed too small for the unaided eye to discover.

These exist in innumerable quantities in the atmosphere, awaiting the condition essential to their germination and development. What these are we have already seen. In the language of Ovid, they are the sun fervently beating on the moistened stalks. When this moisture proceeds from showery weather, no danger need be apprehended; but when from dews precipitated by cool nights, then the rust rapidly develops itself. Whether the moisture in drying so rapidly causes a contraction of the outer portion of the stem so as to induce splitting, or whether the coolness of the night causes it, is not certainly ascertained. Be this as it may, the result is the same—an imperceptible splitting of the straw through which the sap oozes out. The invisible and multitudinous seeds of the rust attach themselves to this sap, and, burying themselves in it, rapidly vegetate, striking their roots in the openings of the straw, thus diverting to themselves the sap of the plant, which should go to the filling out and ripening of the grain. Hence it so rapidly shrivels, and often becomes worthless.

What is the remedy against this evil? The Romans sacrificed a red bitch on the altar of the Goddess Rubigo, the priest entreating her to withhold her rusting hands. If the farmers could be persuaded to sacrifice all bitches to the goddess, then an altar ought to be erected to her on every farm, for the indirect benefit to the wheat crop by increased sheep husbandry would more than compensate all losses from the rust.

The Jewish prophets regarded the blasting and mildew as a punishment for the sins of the people. When a people by rebellion, under such high condition of prosperity as exhibited by the census of 1860, seeks its own and the destruction of others, and the overthrow of the best government the world has seen, blasting and mildew of the wheat crop will not stay their impious hands. But, regarding the remedy for rust, through the microscope we find that it is not in all stages of the growth of the plant that the straw is liable to split under heavy dews and a hot sun. It is not in its growing state, but in its ripening stage only, that this result is produced. Hence, whatever rapidly shortens the ripening stage lessens the danger. For this purpose there is nothing equal to stable manure, the precise effects of which on the soil and on the wheat crop will be stated under the head of manures. Another remedy is in immediate harvesting when the crop is affected by the rust. The following instructive experiments on this point I find in Mr. Klippart's essay on wheat. Mr. George D. Hendricks, of Preble county, Ohio, writes Mr. Klippart as follows: "In 1842 I had a large field seriously affected by rust, and, having read in the Genesee Farmer the necessity of early cutting, I put a hand cradle to work and left; was absent a few days, and, on my return, found my hand had only cut a few dozen of sheaves, avowing that it was so green he knew it would be worthless. I then procured hands, and had the field cut, but too late for more than *half a crop,* whilst the portion cut at first was plump, and had well-filled grains."

"In 1840 I had three fields of wheat of equal size; about the 20th to the 25th of June the rust made its appearance in its worst form. The cholera being in the country, hands were hard to procure. I however procured two cradles, and set them to work in field No. 1; soon left for the day, and, on my return home, was vexed to find my foreman had abandoned the field, with the declaration that if I was fool enough to cut wheat so green, he was not! I explained, entreated, and finally got the field cut on *Monday* and *Tuesday* of the week, leaving the wheat in the swath, unbound, until it partly cured in the sun before binding. Field No. 2 was left, partly to meet the views of my hands, and partly to mark the difference, as an experiment, until Thursday and Friday, when it was cut and shocked. Field No. 3 having been put in by a tenant, and under his control, was left until the Monday following, though I urged him to have it harvested sooner. On Monday all hands were ready for

the work, but on close inspection there was *nothing* but straw to cut, and hence the field was left unharvested."

"*The result.*—Field No. 1, although it was the poorest set or stand by at least one-fourth, produced twelve measured bushels of wheat to the acre, weighing fifty-six pounds to the bushel. No. 2 yielded eight bushels to the acre, weighing only forty-six or forty-eight pounds to the bushel, while the third field, fully equal to the second field in every respect, and the same kind of wheat (white chaff beardy) produced nothing. Again, in 1857, (last year,) the rust made its appearance, but not so fatal in its consequences, but enough to do great damage. So soon as discovered I 'pitched into' field No. 1, cutting and shocking the same day. The crop was so green I had to reopen the shocks and many of the sheaves to cure them, to keep from moulding, as I also did in field No. 1, in 1849. Field No. 2 was left a week, being a late sown field; and again had a field No. 3 in charge of a tenant, who obstinately refused to cut it until ripe.

"*Result.*—No. 1 produced twenty-five bushels to the acre; weight, sixty-four pounds to the bushel, and as full, flinty wheat as I ever saw. No. 2, being only half set, injured by the fly and freezing out, produced ten bushels to the acre, weighing fifty-six pounds; but in this field, and in the poorest point in it, (clay land,) I had manured one acre in the centre of the field, and on which was, at least, thirty bushels of No. 1 wheat. Neither the rust nor fly had affected it. No. 3 yielded (though a good set) some eight bushels to the acre, and the wheat so poor it could not be sold, and I am using it for feed."

The results of these experiments are like others that have been made. But we see from them how very reluctant farmers are to cut wheat until it is fully ripe, and hence the heavy losses sustained from the rust. The reason of the above results is found in the nature of the ripening process of the wheat plant. From ten days to two weeks in the United States before it is fully ripe the stem of the wheat plant will be found turning yellow immediately at the ground, indicating that the roots have ceased to supply further the plant with sap. Hence whatever sap and nutritious elements are yet necessary to fill out the grain must be in the stem and leaves. These the rust plants appropriate to themselves whilst the wheat remains uncut. But it is evident from the foregoing and similar experiments that the cutting *destroys the life of the rust plants,* leaving to the grain the sap and nutritious elements still in the stem. Every farmer has observed that when maize is cut up green, in a few days the grain will be shriveled and loose on the cob; but in two or three weeks, when the stalk is pretty well dried, the grain is full and tight on the cob. This arises from the continued course of sap to the cob, and from it to the grain. If this is the case with the maize, where the action of the root continues until the ear is thoroughly ripened, how much more likely is it to be the case with the wheat plant, whose roots cease their action before the maturity of the grain? How or in what way harvesting the crop destroys the vital action of the rust plant I have no means of determining; but it is worthy the most careful microscopic observation.

The Smut and its remedy.—The disease of the wheat crop destroying the grains of the wheat by enclosing in the husk a fetid black powder is known as the smut. It is the most singular of all parasites. This powder, when viewed through the microscope, is seen to be a collection of small seeds, which adhere to the wheat when all are thrashed together. Whilst growing, the wheat plant absorbs these seeds with the sap which enters the roots, and when thus introduced into the interior of the plant, they germinate and use the sap of the plant and its entire organization, even to the husks of the grain, to the production of its own seeds. The plant thus affected by smut does not grow as large as a healthful one, and exhibits a very dark green appearance from the blackened sap within. It is said that heads have been found containing some good

grains and some smutted ones, but I have never seen any such, and doubt whether it is possible for such a mixed growth to be.

How long the seeds of smut can retain their vitality when lying on the soil, or what are the conditions extending or limiting their vitality, I have no means of ascertaining. A neighbor, very particular to eradicate every head of smut from his fields by sowing no seed at all mixed with it, or allowing a smutted stalk to mature, stated to me last season, with all his care, he found a good many heads of smut in his wheat. Upon inquiry, I found that they were in the vicinity of an old decayed straw pile which he had scattered, and which had some smut in it when threshed. From this it would seem that the seeds are capable of retaining their vitality for several years when mixed with straw. I am making an experiment to test their vitality on the ground, having hogged down a field of wheat with much smut in it, arising from the use of bluestone in insufficient quantity to destroy the smut. The *remedy* against smut is by soaking the seed wheat in washes of different kinds, among which is that of dissolved bluestone, having considerable strength, during one night, and then mixing quicklime with the still wetted wheat. Another is to use salt instead of bluestone, soaking the same time and followed by the same application of quicklime. These destroy the vitality of the smut seeds. Should these seeds lose their vitality when exposed on the soil, or by an intervening fallow crop, the careful farmer, by these steps, can easily protect himself against this parasitic plant.

3. *Does wheat turn to Cheat?*—I may here dwell for a moment on that vexed question whether wheat turns to cheat. I have examined, very carefully, many fields of wheat sown on very poor ground, and on good ground, in years when the wheat froze out badly, and at times when it did not. In no case have I seen the slightest evidence that such transformation took place. I have seen wheat plants with scarcely any life in them—short, stunted, with but two or three grains in the head, and of a most sickly color. These were in very poor ground, and much injured by freezing out. There was plenty of cheat among them, but these all had the healthy growth—the dark green color—altogether different from that of any wheat plant, with its form of leaf and stalk as different. Wheat and cheat are sometimes found growing apparently out of the same stem, but so have trees of entirely different kinds. When traced out the stems had their own roots.

Cheat is a peculiar plant. It came up so thickly on a field added by purchase to the farm on which I am residing, that I cradled it for feed, finding it better than oats for horses. I cut it too ripe, and the ground was covered with seed. The same fall I had it ploughed up and drilled in rye. Scarcely any cheat was seen the next season. The ground was not disturbed, and the following season it again came up thickly. Mr. George W. Lane, of Aurora, Indiana, a few years ago presented to the State Board of Agriculture of that State a specimen of cheat, accompanied with the statement that his own and his neighbor's old and well-established timothy meadows, where hay is raised and baled for the southern market, instead of producing timothy, had that year yielded a good crop of cheat, which they had cut for hay, but without knowledge of its value. This statement exhibits the peculiarity of the cheat plant. It is a most excellent hay, and is altogether a too respectable plant to be the product of a badly put-in wheat-field.

The parasitic enemies of the wheat-field are the Hessian fly, the chinch bug, and the midge.

1. *The Hessian fly and its remedy.*—The received account of the introduction of this fly into the United States is known by every person, for its common name refers to it. That it was brought in some straw with the Hessian troops, employed in the revolution against us, is possible; but the history of like pests shows that sooner or later they spread over the whole earth where their favorite

food may be grown and climatic influence will permit. The bee moth and the curculio are instances of the fact that nearly all the products of the farm have their enemies. It is not necessary to describe this fly, nor particularize the nature of its depredations, except to say that it deposits its eggs, from twenty to forty in number, in the hollow of the blades of the wheat. The egg hatches a small, light-colored worm, in from four days to three weeks, according as the weather is warm or cool.

The worm crawls down the leaf between the sheathing of the leaf and the stem, firmly fixes itself there, sucking the juices or sap of the plant on which it lives. It gradually becomes imbedded in the stem by the latter growing around it. As it increases in size, it becomes, in color, size, and shape, like a flax seed; hence this state of the larva is called the flax-seed state. In this condition it remains during the winter, unaffected by the severest cold. In May it is changed into the fly, and this fly lays its eggs higher upon the same stalk, and on others around it, and also on the spring wheat. These eggs hatch, and the worms undergo the same changes until in August, when they appear as flies, ready to deposit eggs on the young fall wheat plants. The fact that of so many eggs but few hatch (for not more than two or three worms are found in the same plant) shows that the Hessian fly has its deadly enemies. This is true, two of which I will notice, being parasites of this parasite. Both these are flies, one of which deposits its eggs within the egg of the Hessian fly. Both these eggs hatch, but the worm from the last-deposited egg is within the worm of the Hessian fly, and it lives upon it, gradually destroying it, until, having undergone its various changes, it emerges from the skin of the Hessian worm a fly, ready to deposit its eggs in those of the Hessian fly. The other parasitic insect lays its eggs in the larva when in the flax-seed state, which hatches within it and lives upon it. It is to these friendly insects we owe the fact that the Hessian fly does not spread over large districts of the wheat region, nor, indeed, in any part of it to any great extent, and that it is seldom destructive in the same place for more than a season or two. The friendly flies, by their rapid increase, soon drive the Hessian fly to other portions of the country in order to shun their fatal attacks. The usual *remedy* against the Hessian fly is late sowing of the winter wheat. Whilst this may afford some protection, it leads to habitual late sowing, by which the plant is weakened, and rendered less able to endure the changes of our winters. A greater loss is thus occasioned than would result from an occasional entire destruction of the crop by the fly. A strong-rooted plant will more easily overcome a serious attack of the fly than a late sown and weak one can resist the freezing out to which it is certain to be exposed.

2. *The Chinch bug.*—In the northwestern States this bug has not been destructive, but in Missouri and in the southern States it has been at times a severe scourge. I have seen it but once, and then it quickly disappeared, doing no material injury. In the latter part of the last century it first appeared in the south, rapidly multiplying until its vast numbers destroyed every green plant. All crops are its prey—the maize and the grasses, as well as the cereals. They cover every portion of the corn plant, and suck out its sap so rapidly that it wilts as if it had been cut down. No remedy to lessen its numbers or to mitigate its ravages is yet known. A wet season is fatal to it, as to most other of the noxious insects.

3. *The Midge.*—With this insect I have no personal acquaintance; but the census report of 1860 tells its destructiveness in New York in the greatly decreased wheat product of that State. In 1850 it produced 13,121,498 bushels, and in 1860 but 8,681,100 bushels.

There appears to be a difference between writers on the character and habits of this fly, but Asa Fitch, of New York, must be regarded as the best authority, from his personal inspection of it, and from his thorough knowledge of what-

ever relates to the injurious or beneficial insects of the farm. In his report to the State Board of Agriculture of New York, it is stated, that although it was not before known in this country, yet it suddenly appeared over many portions of the New England States and of New York, and that this was accounted for by the remarkably prolific character of the insect. It commences to bear when but three days old, and produces four young daily; thus in twenty days the progeny of a single midge is upwards of four millions. It has existed in Europe, and is there mentioned as depositing its eggs in the soft grain of the wheat in June and July; but here, he says, it is on the field always, sucking out the juice of the young plants, causing them to wither and die. As yet he has been unable to find a male among them; seemingly all appear to be females; and that it has no natural enemy in this country as it has in Europe. The New York State Agricultural Society has imported these enemies with the hope of diminishing the ravages of this noxious insect. In one particular it is different from other insects. Dry weather is favorable for their existence and reproduction, but unfavorable for the midge. It not only attacks the cereals, but the grasses also; and hence, if grain-production was abandoned for some years, it would not tend to diminish the number of this destructive insect. In Mr. Klippart's essay I find it described as a small, yellow fly, which appears about the middle of June, and during the early part of the evenings deposits its eggs on the heads of the wheat just before it blooms, and when it begins to open its coverings of leaves. When the larvæ are hatched they are white, but soon turn yellow, and live on the juices destined to fill the grain, which they appropriate, either wholly or partially, to themselves. When their growth is attained, they spring off the head to the ground and pass into the earth at the root of the plant, where they remain until transformed into the fly. No remedy has been found against its destructiveness, except by means of the propagation of its natural enemy. This is a dark fly that deposits its eggs within that of the midge, as in the case of one of the enemies of the Hessian fly. The worms hatched from these live within and upon the larvæ of the midge, but do not effect their destruction until they have left the wheat heads and descended to the earth.

The casualties affecting the wheat crop are but two—blowing down whilst in ear, and freezing out during the winter.

1. *Blowing down.*—This casualty does not often occur to a serious extent, but it is a partial evil at nearly all times. I was forced to hog down my crop this year on account of it, and the long laid-by sickle had to be used very generally in this county. This evil may be much avoided in two ways—by selecting good varieties of wheats which have stiff straws, and by returning to the wheat crop the straw of previous crops, or the manure of stock fed upon it, for both have large quantities of silica, so essential to strengthening the straw against the storms which so frequently occur before harvest time.

2. *Freezing out.*—This casualty is, perhaps, more destructive to the wheat crop than all other misfortunes to which it is incident. Freezing out is of two kinds. In the northern districts of the wheat region where the soil is light, but rich, and the winters dry and cold, the strong prairie winds blow the snow from the fields when it has not fallen in sufficient quantities, exposing the light soil to freeze into dust, which is blown from the roots of the wheat, thus laying them bare, when they are soon destroyed by freezing. The only remedy is in substituting spring wheat for winter. The other kind of freezing out occurs in the middle and southern portions of the wheat region, where the soil is more generally a tenacious clay. This soil retains the rains, and, as there is a deficiency of snow, the water freezes, and in expanding swells the ground upwards, breaking the roots that may be below the freezing, and forcing up the remaining parts of the roots with it. A gradual thaw first melts the ice near the surface, and as the soil is freed from the water it falls from and below the roots which

cannot sink down with the soil, for the lower portions of the roots are still imbedded in frozen ground. In this way most of the roots are gradually thrown on the surface, where they freeze. The remedy against this natural and wide-spread evil is to render the ground more loose by enriching it with stable manure, which will give a more ready passage to the water below the roots, and will also give a more vigorous growth to the roots; by early sowing, which gives more time for the roots to obtain such growth, and by the substitution of drill planting for broad-cast sowing. I shall recur to all under their proper heads. Having considered the nature of the wheat plant as to its varieties, elementary constituents, germination, and growth, and the diseases, enemies, and casualties to which it is subjected, and the remedies of these, I proceed to the second head of the last general division of this essay, namely:

2. THE BEST SOILS FOR WHEAT PRODUCTION.

These I shall divide into two classes, natural and artificial:

Natural soils.—A cereal so universally consumed as wheat is not limited in its growth to a particular kind of soil, as has often been stated. The red and yellow clays, sandy loams, or light, carbonaceous soils, are all well adapted to its production under the conditions we generally find them as to depth of snows and the kind of wheat. Where deep snows protect the crop, as north of the southern margin of our northern lakes, a light, carbonaceous soil is productive, which in more southern latitudes would be unsuitable. Where the snow is not an adequate protection, the substitution of spring wheat obviates the natural difficulties to which the winter varieties are there subject.

In the southern and middle portions of the wheat region the tenacious clay soils are made more productive by manures, deep ploughing, drainage, and drill-planting. And where clay subsoil underlies a light carbonaceous top soil, the mixture of them by deep ploughing is highly beneficial. Hence arises—

Artificial soils.—I include under this head those ameliorated by deep ploughing, drainage, or manures. The necessity of the first and second of these depends upon the character of the land. A level, tenacious clay soil, which is not made dry by one or both these methods, is unfit for wheat production, for no plant more demands a dry soil than wheat. This is seen not only in its liability to freeze out, but in the superiority of the wheats of dry climates, such as California, and in the marked excellency of the crop of 1856, when no rain fell on it from the opening of spring until it was harvested. I must content myself with this reference to their utility, desiring to dwell more at length on the third means of ameliorating the soil—manuring. There are three kinds of manures that may with profit be used by the generality of farmers: barnyard manures, green manures, and some mineral manures.

1. *Barnyard manure.*—There is no crop that shows so quickly and to so great an extent the benefits of this manure as the wheat crop. The effects of the slightest manuring are readily seen. It gives a strong fall growth to the roots of the plant, enabling it the better to endure winter freezing, and by its pulverizing agency renders the soil friable—a condition so essential to a vigorous growth. Its summer influences are not less beneficial. This vigorous growth of the fall is early resumed in the spring, enabling the plants to overcome the attacks of the fly. It rapidly hurries them through the ripening stage, thus lessening, as already stated, the danger from rust. Mr. Hendricks, in the letter already quoted from, refers to both these; when speaking of one of the fields, he says: "In this field, and on the poorest part in it, (clay land,) I had well manured one acre in the centre of the field, and on which were at least thirty bushels of No. 1 wheat; neither the rust nor the fly had affected it." This was his experience in a season when the rust was very bad, and the Hessian fly had injured other portions of the field. These most desirable results are pro-

duced by the manure furnishing an adequate supply of mineral substances, such as the ash analysis of wheat shows to be a part of its elements, potash, phosphoric acid, and silica. By rendering clay soils darker and looser, they attract greater heat and dry it out rapidly, rendering the condition of the soil more like that of the dry, trade-wind region. It is in this heat and dryness that a wheat soil materially differs from a maize soil. The one should always be dry, the other always moist. In an article on Indian corn, published in the Agricultural Report of the Patent Office for 1861, the writer showed at some length the necessity of much humus in the soil for that crop; that by its action as a non-conductor of heat it retained the moisture in the soil. But the wheat crop is injured by such retention. Its growing season is so long protracted, and its ripening stage so slow in its changes, that the rust is almost certain to fall upon it. This is a common complaint in rich western lands that have but little sand and much humus. And rich clay soils are found to be better wheat lands when the humus is much exhausted; if poor, when enriched by barnyard manure. When this manure is productive of so great advantages, it should be a leading object of every farmer to preserve and increase its quantity.

2. *Green manures.*—One of the most satisfactory parts of the census report of 1860 is the greatly increased amount of clover-seed grown. In 1849 it was 468,978 bushels, and in 1859, 929,010 bushels—an increase of nearly one hundred per cent. The increase is 460,032 bushels, which would sow, at eight acres to the bushel, 3,680,250 acres; and as this crop is always kept for two years at the very least, there was, in 1859, 7,360,512 acres more in clover than in 1849. The increase of other grass seeds have been in proportion. Although good husbandry demands a much greater increase, yet that which has been made gives encouraging hope that the destruction of our soils, so characteristic of our farming in past years, is about to cease, and that green manures will receive that appreciation they so highly merit.

Looking at the extent of wheat cultivation, especially in the west, it is obvious that barnyard manure cannot be produced in quantities at all approaching the demands of that husbandry which should regard the fertility of the soil as one of the highest ends it can have in view. Special manures, such as guano, admissible near the seaboard and for products bearing a high price, cannot be used in the western States. The only means for general manuring is in turning under green clover crops and in hogging down others, such as corn, rye and oats.

Besides returning to the soil so much vegetable matter, a green clover crop thoroughly pulverizes it—a condition, as already observed, of absolute necessity to a vigorous fall growth of the wheat plant. The dryness of our summers, following heavy rains in the spring, so bake and clod our soils as to render them almost unfit for wheat cultivation, when deficient in vegetable matter. A winter's freezing could not more reduce these clods to a proper pulverization than the rotting of a green clover crop beneath them.

3. *Mineral manures.*—There are but two of these that can profitably be used by the western farmer—gypsum, or plaster, and lime. In connexion with clover crops both are valuable, but especially the gypsum, called by chemists sulphate of lime, being composed of sulphuric acid and lime. The ash analysis of clover shows that these constitute a large portion of its mineral elements, and hence the cause of its heavy growth when gypsum is sown on the young clover. This, as well as the great value to the wheat crop of clover so manured, will be seen from the following experiment made by General Orr, of Laporte county, Indiana, whose intelligence and energy have made him one of the best farmers in the United States. His statement to the agricultural society of that county is as follows: "The field contained thirty-seven acres, was of a light, loamy soil of medium gravity; had been covered with scattered trees of burr oak and hickory, with frequent patches of hazel; was brought into culti-

vation ten years ago; had produced three crops of wheat, two of corn, one of oats, and in March, 1853, was sowed to clover among wheat, all without manure. It was pastured in the fall of 1853, and up to the first of June, 1854, when everything was turned off, and on the 10th and 11th of June we sowed six barrels of plaster on twenty-eight acres, leaving nine acres without. Two barrels were of the Oswego and four of the Grand River plaster. The clover grew well all over the field, but best on the plastered part, and by the 20th of July that on which the Grand River plaster was used was all lodged; that on which the Oswego was used, but partially so, while the unplastered part stood up and was much lighter than either of the others. The whole was ploughed under six inches deep, between the 20th and last of July, and the ground well harrowed over the first week in September. The wheat was all sowed broadcast, two bushels to the acre, and well harrowed in, between the 10th and 11th of the same month. The field had been carefully divided, before sowing, into three parts, across the plastered and unplastered parts; two contained twelve acres each, and one thirteen acres. Twelve acres were sown with the Hutchinson (white) wheat, twelve acres with the Soule (white) wheat, and thirteen acres with the Mediterranean. The fly made its appearance on both varieties of the white wheat last fall, but was confined to the parts not plastered. They appeared again this spring all over both varieties of the white wheat, but the wheat grew so strong where it had been plastered that it was well advanced in filling before their effect began to show itself. The heavy winds and rains at the commencement and during harvest so prostrated the affected part that we were unable to gather it, and my best judgment is that three to four bushels per acre were left on the ground. The Mediterranean was slightly injured in a few places, but not to materially affect its yield. We gathered and threshed the different varieties separately, and that which grew on the plastered parts separate from the unplasted part. The result was as follows: The Hutchinson wheat produced $7\frac{1}{3}$ bushels per acre on the part not plastered, and $15\frac{3}{4}$ bushels per acre on the part plastered; Soule wheat produced $8\frac{1}{4}$ bushels per acre on the part not plastered, and $19\frac{1}{10}$ on the part plastered; while the Mediterranean produced $19\frac{1}{4}$ bushels to the acre on the part not plastered, and $20\frac{1}{8}$ bushels to the acre on the part plastered. I had used plaster frequently before with marked success, but had never noted its effects with the same care as on the present occasion. Therefore, from the facts now before me, I draw the following conclusions: 1. That three-fourths to one bushel of plaster per acre on lands which have produced grain for a number of years in succession, applied on a well-set, growing clover crop, at some six inches high, and ploughed under when the seed balls have all turned brown, will add fifteen to thirty per cent. to a succeeding wheat crop over the same clover turned under without plaster. 2. That the vigor imparted to the growing grain by the use of plaster will, in a great degree, prevent the ravages of the fly on such varieties as the fly works most upon. 3. That clover and plaster, on most soils, are the cheapest manures that the farmer can use, yet he should not neglect the use of any others within his reach." He adds that the cost of the plaster used and of putting it on was about $14, or fifty cents per acre.

These extraordinary results were, perhaps, increased by the want of sufficient lime in the soil; but the principal cause must be found in the larger amount of carbonaceous matter yielded by the parts plastered, and its consequent increased friability of the soil. The action of gypsum is to absorb and fix the ammonia in atmosphere and rain water, forming by its union with it sulphate of ammonia and carbonate of lime, ready for the succeeding crop of wheat, which demands ammonia largely in forming its nitrogen of the gluten and albumen. Wheat requires mineral elements more than carbonaceous matter, as every farmer may readily see by noticing how fertile for wheat the burning of an old log makes the soil. The burning drives most of the carbon into the air, in the form of

carbonic gas, but leaves the mineral elements of the tree on the soil. Clover produces one hundred per cent. more in such places, showing that these mineral elements are alike essential to both wheat and clover. When turned under, the clover crop yields all its mineral elements to the succeeding wheat crop, not only those derived from ashes or plaster, but those also which its long roots extract from the lower parts of the soil, drawing them to the surface for the crop that follows it. With results of this importance from the use of gypsum with clover, the development of gypsum beds and its manufacture becomes an object interesting to every farmer, and it is to be regretted that plaster is so scarce to the western farmer.

Lime acts as a manure in three ways: by what it gives directly to a plant requiring it as one of its constituent elements; by decomposing vegetable matter, thus fitting it for the immediate support of the growing crop; and by making soluble the silica and other minerals of the soil. The importance of this last-named action may be seen from the analysis. To every ten bushels of wheat raised there are about 1,200 pounds of straw, and this straw contains 72 pounds of minerals, of which 47 is silica. Where the straw is removed from the field it will be readily seen how great is the need of this solvent action of lime to render the flint in our soils capable of supplying their large amount of silica, for the silica is dissolved flint. But an immediate and visible effect of lime depends upon the amount of vegetable matter in the soil. A neighbor who limed several of his worn-out fields remarked to me that he would not give leaves of trees for any amount of lime; for alongside one of the fields the leaves had blown on it from an adjoining woodland, and on this portion he had raised excellent wheat. Here the lime found vegetable matter to act upon; in the other portions of the field it did not. Hence the liming should be on a full clover crop, and both turned under together, or on a heavy blue grass sod.

3. CULTIVATION.

The third head under the last general division is cultivation, which includes the breaking up of the soil, keeping it loose and free from weeds or grass, selecting seed wheat, the time and manner of sowing and spring harrowing. I will first consider the implements necessary for these operations, which are the plough, the harrow, and the drill, and the times and modes of using them.

1. *The plough.*—It is not necessary to speak of the plough, further than in connexion with the turning under green and dried crops. No operation is more important than this, and none more disliked, from the insufficiency of our plough to its proper accomplishment. The old custom of burning off "the trash" is not yet obsolete, because of the defective turning qualities of our ploughs. The plough has three things to do: to *cut* the furrow-slice, *raise* and *turn* it, and so to do it as to bury all growth upon it. The union of the lifting and turning forces admits of an almost endless variety of combination, but the attempts to make ploughs for general purposes have prevented that attention to a combination best adapted to turning under heavy green or dried crops. A plough choking every few steps is a trial to which the patience of Job was, fortunately, not subjected. To do their work thoroughly, the plough must have stronger lifting and turning forces in front, that the furrow-slice may be quickly drawn from under the beam. My experience has satisfied me that these forces must always be equal. To give them requisite power over the furrow-slice, the share must rise more than it does, with a corresponding rise in the lower part of the mould-board; its top have an equal turning power, and its twist be such that the cleaning and turning will be most quickly and best done. I have seen but one such plough, and the maker, a skilful workman, confessed he could not make such another, although he had the same pattern upon which to turn the mould-board, and the same plough before him to stock by. I men-

tion this to show the great difficulty of properly adjusting so complex a union as the lifting and turning forces of the plough—a problem as hard to solve practically as the mathematical one of the forces acting on the boomerang. Every person knows how often the action of his plough has been changed by the simple act of sharpening the share, and hence cast shares are preferred to wrought ones. When a plough will have been constructed such as I have alluded to, it will indeed become such a fertilizer as Tull and Mechi thought they had found in the constant use of those we have.

2. *The harrow.*—The harrows in general use are too small; they simply level the surface, without pulverizing it deeply. Greater weight and length of teeth are needed. I prefer the heavy double V to any other, for it is less easily tossed about, and consequently forces the clods to yield to it. The usual mode of not breaking our wheat lands until just before sowing, when it breaks up cloddy from the action of our summer droughts, demand that the roller should be alternately used with the harrow until the soil is completely pulverized.

3. *The drill.*—It is not necessary to speak further of it than to name it as one of the indispensable implements of wheat cultivation. Its use will be dwelt upon at length. In selecting a drill, the farmer should choose the most simple in construction, and of these the best manufactured one.

The times and modes of using these implements.—In the use of the plough for the wheat crop there is a wide difference between American and European farming. The fallow system is universal there; here it is scarcely known, and when it is, so partially used that a European would hardly admit that it was a fallow. The causes of this difference are found in the facts that with us the wheat crop is second to that of the maize crop, which requires the constant use of the plough from early spring until the harvest demands the time of the farmer, and that the large amount of humus in our virgin soil made the fallow unnecessary, and established a practice of single ploughing long after the destruction of this humus. But in the fact that it is now so destroyed to a great extent, and much decreased to a still greater, we see the necessity of the fallow, and hence I shall examine its merits fully. I divide fallows into three kinds—the *naked* fallow, the *green* fallow, and the *crop* fallow.

1. *The naked fallow.*—The object of the fallow is to prepare the soil by repeated ploughings for the wheat crop. Its purpose is to enrich the soil by enabling it to absorb more readily the fertilizing gases from the atmosphere, by destroying weeds, and by thoroughly pulverizing it to allow the roots to grow so vigorously as not only to insure a good crop, but also add to the fertility of the land. The celebrated Jethro Tull made the fallow his sole basis of farming operations, maintaining that these elements of the atmosphere and the increased roots of crops more than compensated for the straw and grain taken from the soil. His success was great at first, but in the end his farm became exhausted. Still, while the naked fallow could not accomplish so much, its merits are so great that even where labor is so high as in the United States, it should become an essential part of our wheat tillage. The Romans adapted the naked fallow to its full extent of six ploughings, and so do some European farmers when their object is to deepen the soil, as well as to prepare it for a crop. The general effects of such a fallow on the soil is thus stated by Thaer, the highest scientific and practical authority we have. "A simple ploughing in spring or autumn certainly will turn up and break the surface of the land, but it will not divide it sufficiently to break the clods and reduce them to loose earth. The soil, when clodded together, soon becomes hardened into compound masses when it is covered without being broken. It even preserves the impression made upon it by the plough, and when the ploughing has been performed while the ground was wet the divided portions exposed to the heat of the sun become as hard as tile. Land, when suffered to acquire this state, is highly unproductive, because the greater part of the plants having fibrous roots are

unable to penetrate these clods, and consequently are forced to turn around them, and the power of vegetation contained in the portion of the ground which they occupy is, therefore, wholly lost. The soil might as well be composed, for the most part, of stones, as of mould thus conglomerated. There is scarcely any means by which these clods can be effectually broken except by continued fallowing during the whole of the year, the effect of which is to bring them all successively to the surface, where they may be exposed to the action of the atmosphere, and having imbibed moisture and become softened, they may be broken by the harrow and other implements. If this process can be continued from the end of summer to the seed time of the following autumn, and care be taken that each operation shall be performed when the soil possesses the proper degree of humidity, the field will be transformed into a light, loose powder, and the nutritive and fertilizing particles which it may contain will be brought into action. Thus we frequently see fields which were to all appearances exhausted become exceedingly fertile after having been carefully fallowed, even though they have not received any additional supply of manure." *He thus sums up the benefit of such a fallow:* "1. A suitable increase in the depth of the layer of vegetable earth by means of deep ploughings. 2. The reversion of the earth. 3. Its pulverization. 4. Its due admixture. 5. Its exposure to the influences of the atmosphere; and 6. The destruction of all the weeds on it. If, by means of a fallow, all these advantages can be obtained, the benefit arising from it will be sensibly felt through a long series of years."

I have given these extracts as showing the nature of these long fallows and their important results. It is the system of Mechi, now attracting so much attention. They show the cause of an evil we all acknowledge—that of stirring the ground when too wet. When stirred too dry, as our wheat culture almost always finds our fields, the effect is not much less injurious, for the clods beneath the surface are not pulverized except by severe winter freezing, which comes too late for the fall growth of the wheat. When the soil has such a combination of clay loam or sand loam and humus that it does not bake or become cloddy, a single ploughing, if early done, and well harrowed before sowing, may be sufficient; but how few of our fields have such soil. With the aid of the ameliorating effects of our severe winters, three ploughings would probably suffice for our most exhausted soils; the first in the fall, the second in June, and the third in September, at the time of sowing.

2. *The green fallows.*—I have given this name to the turning under any green crop as a manure for a succeeding wheat crop. The proper time of turning under is when the united purposes of manuring and pulverization can best be accomplished, and this is when the ground still has enough moisture to break up loose, and the green crop time enough to rot before sowing. In the experiment of General Orr we see that he ploughed the clover under in July; but, as usually performed, neither of these objects are fully attained. The ploughing is deferred until the beginning of September, when the ground breaks up cloddy, and the clover has not time to decay so as to immediately benefit the wheat crop. The ploughing is deferred until this late period from habit, in order to complete the hay harvest, thresh the wheat, and to give time to the clover seeds to ripen that the ground may seed itself; but by this postponement I am satisfied much more is lost than gained. So with our oat crop. It is usually hogged down in August, for it is not turned under when green, that the oats may ripen. By the time it is eaten the ground is dry and hard from the trampling of the hogs, and when ploughed in September the dry straw has not time to decompose.

3. *The crop fallows.*—In countries where root crops are extensively raised, as the turnip in England, and fed upon the land, or in time for the manure to be returned to the soil, this kind of fallow is one of the best preparations for a wheat crop. But we produce root crops to a very limited extent only, and our

only crop fallows are tobacco and corn. The early maturity of the tobacco, and the clean cultivation it requires, would make it a good fallow, were it not too exhausting on the soil, and grown in too limited quantities to answer for a general fallow. Much wheat is sown in the corn, but this crop is also exhausting, especially in silica, which is not returned to the soil in time for the wants of the wheat straw; besides, the wheat cannot be drilled in, but is sown broadcast. These difficulties make crop fallows of little utility in our farming. There are two matters necessary to be noticed in connexion with these fallows—the proper depth of the ploughings and the times of manuring them when barnyard manure is used. When the naked fallow is first ploughed in the fall, this ploughing should be deep when the deepening of the soil is desired, for then the subsoil can be ameliorated by the action of the frosts. If the fallow is a summer one only, the subsoil should not be disturbed, for it will be unfit to mix with the top soil.

There are many seeds which require great compactness of soil. All grass seeds are of this character, for the delicate fibres of their roots perish in a loose soil when dried. This is the reason why grass seeds sown on oats so often perish. The experiments of Peter Love, of England, shows that wheat is also injured to some extent by such loose condition of the soil. He raised a crop fallow of potatoes, and after they were dug put the ground in wheat, ploughing one portion ten inches deep, another five, and another three. The yield was as follows:

10 inches ploughing..................	27	bushels per acre.
5 inches ploughing..................	31¼	"
3 inches ploughing..................	32	"

The experiment indicates that the soil below the grain should be somewhat compact, even in the moist climate of England. Our dry climate would require it still more. Hence the last ploughing should be shallow; or if the ground is loose from the turning under a green crop in time to decompose, a thorough harrowing would be sufficient. Another reason why the surface only should be stirred in such a case is, that the decomposed vegetable matter should not be turned on the surface, but remain in close proximity to the roots of the wheat crop. When barnyard manure is to be used in connexion with the fallow, if it is unfermented it should be spread over the ground before the first ploughing, if it is a summer fallow. If a winter one also, not until the second ploughing, for the winter rains would carry the strength of the manure too deeply; if the manure is fermented, not until before the last ploughing. This and the harrowing would well mix it with the top soil, where it is most needed, for the fall rains would carry its fertilizing properties to the roots of the wheat.

Harrowing.—So far as my observation enables me to judge, there is no operation of the farm, connected with wheat production, that is so carelessly and slovenly performed as harrowing. To level somewhat the surface seems to be the only object with most, and not such a pulverization of the soil as the wheat crop demands. In the moist climate of England this is well performed; but here, where the dryness of our falls and the cloddy condition of the ploughed ground demand especial care, it is performed with a light harrow, tumbling about over the clods, rounding them somewhat and raising a dust. To be used effectively the harrow should be such as I have mentioned, and should follow the plough closely, for our fall winds are so drying that in a day or two the clods are as hard as Mexican adobe. The fallow would do more to pulverize the soil than the harrow, and hence a summer ploughing would save much harrowing.

Rolling.—Upon the supposition that there has been no fallow, it is almost an impossibility to pulverize the soil, unless the roller and the harrow are used alternately until pulverization is effected. This is not done, but the labor that

should be devoted to it is given to ploughing another field—demanding more seed, more labor in cutting, with a less yield than if what had been done were well done. Better have the second field in clover than making it the pretence of a wheat-field.

Selecting seed.—The varieties of wheat are so numerous, and their peculiar excellencies so dependent on soil, climate, and cultivation, that an enumeration of these varieties would be useless. Farmers should compare wheats with each other, and when the best is found it should be preferred, although its purchase may require a small outlay of money. When a good variety, such as yields well, is hardy, and commands a good market price, has been obtained, care should be taken to improve it. This can be done in various ways. The anecdote of the origin of the barrel wheat is well known. A farmer was in the habit of selecting his seed wheat by striking the sheaves across the head of an empty barrel; and as the largest, earliest matured, and the best grains shattered most easily, he thus selected them. He soon became celebrated for his superior variety of wheat, and sold large quantites for seed. He called it the "barrel wheat;" a better name would have been common-sense wheat. Every farmer should raise his seed wheat separate from the general crop, on well-manured and well-prepared ground. It should be sown early, and nothing but wheat should be allowed to mature; cockle, cheat, and smut should be carefully weeded out of it. It should be threshed with a flail or across the head of a barrel, and then passed through the best fan mill that can be found or had. How many thousands of farmers, for their seed, now go to the pile of wheat thrashed by horse-power, with its immature grains, mixed with cheat, cockle, and smut, and sow it, expecting to reap a good crop, but forgetting that they have been told "as ye sow so shall ye reap." The product of such wheat-sowing is brought to every wheat-buyer, and the one nearest to me has to keep a fanning mill to purge it. Since horse-thrashers are so universally employed, but few farmers keep a cleaning mill, and the result is, that cheat raising is on the increase, and so is the notion that wheat turns to cheat. So it does, but in a very natural way; the seed produces its kind.

Time and manner of sowing.—The winter wheat is a biennial plant, and the best opinion is, that if sown as early as June it would not shoot the first summer. I do not know that any experiment has been made to test the correctness of this opinion; but it is practically not important, for the Hessian fly threatents the destruction of early-sown wheat. The first week in September is universally regarded as the best time for sowing; but when the fly is apprehended it is delayed from two to four weeks after this. My opinion is, that a greater injury follows this late sowing than benefit. The occasional saving of a crop from the ravages of the fly is but a poor return for the greater loss. The fear of the fly is too common, and is often only an excuse for our tardiness. The sowing is postponed until the dry weather of Indian summer sets in, during which the wheat makes but little growth. This is followed by rains and severe freezing, which tears out the tender and feeble roots from the soil, and thus a worse evil than the Hessian fly is brought upon the crop. Under no circumstances should the time of sowing be later than the 10th of September.

2. *The modes of sowing wheat.*—These are of three kinds—sowing broadcast and harrowing the seed in, sowing the same way and ploughing it in, and drilling it. I will not consider them separately, but refer to some of my farming experience and observation to set forth their relative merits. The first year of my farming I had twenty acres put in wheat, which was sown broadcast and harrowed in about the 1st of September. The last rain previously was on the 20th of August, and the next was on the 20th of October. The soil was good, tolerably well broken up, and harrowed. The seed commenced to sprout, some came up, when the drought checked the further growth.

I examined its condition every day, and soon found insects preying on the sprouted grain. The worst of these was the small, red ant, which eats out the softened germ, attracted apparently by the sugar formed from the starch. When the rain fell, in October, the grains uninjured came up, but there was not one in twenty of what had been sown. The twenty acres yielded 109 bushels. In the same fall, and about the same time, a farmer of this county broke up a small field; and with the first drill that came here he drilled in a portion, sowed another broadcast and ploughed it in, and the other portion he harrowed in. The drilled wheat came up slowly, and grew slowly but steadily. Not many grains failed to come up. That ploughed in came up in irregular patches, and in some places apparently in rows, where it had been covered deepest. It suffered much from the drought, and much never came up at all. But little of that harrowed in came up, and seemed to yield to the drought where it did. When the rain fell these portions retained their relative positions, and the yield at harvest was in accordance with their fall growth. Again: some years after, when drills were becoming popular, there occurred one of these freezing-out winters that destroy our clover and wheat fields. A neighbor who had put in well a field of good soil, with wheat sown broadcast and harrowed in, had it completely frozen out. He remarked to me that he could well have afforded to have purchased a drill to put it in, and then to have burnt it, rather than sustain the failure from broadcast sowing. I examined that spring, with much care, many drilled fields and many sown broadcast, in some of which the seed had been harrowed in and in others ploughed in, and invariably found the drilled wheat firmly fixed in the soil, with no roots on the surface, except here and there where a wash had carried the top soil away. But in the other fields there were but few plants that had not many roots on the surface; most of them had no root in the soil; many but a portion of a single root. In pulling the drilled wheat it was firmly fixed, the crown close on the surface soil, whilst the other yielded, showing the crown above the soil, with a portion of the roots below it exposed. This was the case with the best of the plants. To such facts I will be told (for I have often been) that one of the best crops of wheat raised by the farmer answering me was from broadcast sowing. I grant this; but under what circumstances was it done? When the soil was at its best, when no drought occurred in the fall, and no freezing out in the winter. Why recollect the one successful crop and forget the many unsuccessful? Let us now examine into the causes of this great difference between the drilled and broadcast-sown fields. In making my examination I dug up some of the drilled plants, and some of the best sown broadcast. The secondary roots of the drilled plants were double in number compared with those of the broadcast sowing, much longer, with a much greater number of fibrous branches, and with an inclination deeper in the soil. These are the facts, and the philosophy of them will be seen from what I have said on the germination of the seed and the growth of the plant. Wheat put in with a drill is sown at the depth of about three inches. The seeds are placed regularly; the space for the growth of each plant is equal. If a drought comes on, as it so often does in our falls, the grain is so far down that it is not much affected. Plants have two sources from which they derive the moisture necessary to their growth in time of drought—that which descends through the atmosphere in the form of dew, and that which rises up through the subsoil. Rain is the common source of both these supplies. When drought parches the surface soil, the dews are of little or no consequence to the roots of plants; its purpose is, in its daily evaporation and nightly condensation, to envelop the blades or leaves and stems with a moist atmosphere. The sources of their evaporation are supplied in droughts by the evaporations of the subsoil moisture through the leaves of plants and trees and from the surface of the ground. Their subsoil moisture is drawn to the surface by capillary attraction, and the heated and dry condition of the

surface, air, and soil. As it ascends, the roots of plants lay hold of it and carry it to the stem, branches, and leaves. An observation of twenty years, and constant examination during the years of our great droughts of 1854 and 1856, convince me that this is the precise office of dews and subsoil moisture. A law of the growth of the root is, that it always turns to the source of its nutriment. Now, the grain of drilled wheat being deposited as deeply as its germination will allow, its roots, both the primary or tap root, and the secondary, are beneath the influence of the surface droughts, and, receiving their moisture from the subsoil, they turn toward it. Hence the fact of the roots of drilled wheat having a downward inclination. The wheat covered in by the harrow lies so near the surface that a drought soon dries the soil around it, stopping the growth at all stages. The roots get their moisture from the dews at night, meeting the evaporated subsoil moisture at the surface of the ground, and the roots, finding their chief supply at that point, incline to the surface. Hence they are checked in their autumnal growth, and are soon laid bare by the freezing of winter.

Spring harrowing.—In English husbandry there are cultivators so constructed that a tooth passes between each of the drilled rows of wheat, there being as many teeth as that of the drill. There wheat is rather cultivated than harrowed. But in the United States, where the rigors of winter and the dryness of spring (cracking open the soil) render the use of the harrow more imperative, it is almost wholly neglected. The reason of this is the pressing demand of spring labor for the corn crops, and the custom of sowing clover seed on it in March. Still, there are many who could harrow their wheat-fields, but do not, simply because it is not usual to do so. I quote Thaer to show its utility:

"Wheat requires more careful and continuous attention throughout the whole period of its vegetation than any other kind of cereal, and it amply repays all the labor and pains bestowed upon it. If it is only just beginning to vegetate in the spring, and the soil is tolerably dry, nothing will prove so beneficial as to pass a harrow, having iron teeth, over it. By this means the crust will be broken up, which has been formed over the ground during the past winter, and the superficial stratum of the soil brought into direct contact with the atmosphere; the coronal roots, which shoot about this time, there find around them a soil recently impregnated with atmospheric matter, which tends greatly to favor the growth of the plants, while those weeds which shoot up at this season will all then be destroyed by the action of the harrow. A fine day should be chosen for this operation, which must be boldly undertaken. If, after this, the field has every appearance of being newly sown, and no green leaf, or, indeed, anything but the bare ground, is perceptible, then there is every reason to hope that the operation will be attended with success. Should a few torn leaves or blades of wheat be perceptible, it will not matter, provided that the plants themselves are not torn up. After a lapse of eight or ten days, if the weather is favorable, the plants will be seen to shoot up afresh, and the field will present a much better and greener aspect than it did before the operation. The farmer may be pardoned for anything but the omission of performing this operation at the most favorable and propitious moment. Everything else should be set aside for the time being, in order that all the teams may be brought to work in harrowing the wheat-fields."

I heartily concur in all that he says, and my experience is, that it is almost impossible to pull out any of the plants. Drilled plants would defy the harrow. The "propitious moment" in this country for harrowing is in April, when the surface is dry and cracked open. Clover seed should be sown immediately after the harrow, and before any rain has fallen.

4. HARVESTING.

The fourth and last head under the second general division is *harvesting.* It includes the proper time for cutting, the best mode of doing this; binding, shocking, and stacking; threshing and cleaning; the proper place to stack the straw and how to dispose of it.

1. *The proper time for cutting.*—Thaer says: "Wheat which is intended for sale should be cut before it comes to full maturity, otherwise it assumes a dusky appearance, and does not yield such white flour. Besides, wheat is always disposed to shed its seed; in dry, windy weather there will be some danger of a great deal being wasted if the crop is allowed to get too ripe. The exact period at which the harvest should be commenced must, therefore, be carefully chosen, and that has arrived when the grain has formed its farina, ceases to be milky, and yet has not hardened." Here he evidently refers to what is called the *dough* state. In England experiments have been made to determine the best time for cutting. The results of one of these show that wheat cut two weeks before it is fully ripe yields more and better flour and less bran than when cut later. The American farmer understands the different stages of maturity by the terms "in the milk," "in the dough," and ripe." The state of the straw in these stages is this: in the first it is yet green; in the second yellow at the ground, but all other parts green, but showing a speedy change to yellow; and in the third it is all yellow. In the English experiment the wheat was cut in each of these stages, and the yield of flour and bran was as follows:

No. 1, cut when in milk...	75 pounds flour,	7 pounds shorts,	16 pounds bran.
No. 2, cut when in dough..	80 " "	5 " "	13 " "
No. 3, cut when fully ripe..	72 " "	11 " "	15 " "

This experiment indicates that in the last stage of ripening the bran of the grain becomes thicker at the expense of the starch. There is a general concurrence in the opinion that wheat cut in the dough makes fairer flour; but we have had no carefully made American experiments to determine the matter now under consideration. I have cut small portions of wheat when green, so that it yet showed some milk, and it did not shrivel, nor did the straw mould. The weather, however, was dry.

2. *The best mode of cutting.*—The statistics relating to farming machinery, in the census report for 1860, furnish the experimental opinion of the American farmers. The value of such machinery, in 1850, was $6,842,611, and in 1860, $17,862,514, an increase of 160 per cent. A large part of this machinery was the reapers. In the last ten years they have been introduced into every portion of the wheat region, but especially in the northwestern States, where the scarcity of labor and the increased wheat production rendered their aid indispensable. Even if they were no speedier than the cradle, the fact that it substitutes horse-power for human labor, is sufficient to insure their general use, for in this way harvest labor is doubled, and therefore the harvest crop may be doubled. The reaper is one of the leading causes of the greatly increased wheat product of the country. During the past year the crops could not have been secured, owing to the absence of so much farm labor, had it not been for the great increase of reapers.

The power and wealth of Great Britain consist in its vast machinery. With a population of 21,000,000, it uses steam-power equal to the labor of 600,000,000 of men. We have grown great by the use of labor-saving machinery in our manufactures and transportation, and the more it is applied to agricultural pursuits the cheaper production will become, and, as a consequence, more will be raised and consumed. In selecting a reaper, the farmer should be governed by

the fact that it is well made and of good material, rather than by any supposed or real superiority of the patent. A badly made one soon becomes a loss of time and a constant vexation.

3. *Binding, shocking, and stacking.*—The harvest season of 1862 reminded us of the necessity of doing these matters well. Whilst rains are not usually to be apprehended during our harvest, yet they often come unexpectedly. In binding, the bands should always be tightly drawn, else in the curing of the straw they become so loose that the hauling in and stacking are retarded—a time when expedition is necessary. *Shocking* cannot be too well done. Not more than one dozen sheaves should be put in a single shock—ten in the body of it, and two used as cap sheaves. In building it the butts should be firmly placed on the ground and in the stubble, and the sheaves firmly balanced against each other, else they will slip, and the shock fall down. The tops should be well pressed together, and the cap sheaves well spread out and firmly put on. After every heavy wind they should be examined. *Stacking* is often too carelessly done. With the expectation that the threshing-machine will soon come, the work is done less for the preservation of the wheat than that it may undergo a sweating. "What is done should be well done," is a motto applicable to this part of the harvest work. In stacking, the middle must always be rounded well, firmly built, and the outer sheaves be considerably inclined. To prevent slipping, the butt straws of each sheaf should be well forced into those of the sheaves on which it is to lie. The topping must be carefully done, leaving no place for rain to penetrate, and so fastening the top sheaves that they can neither slip nor blow off.

4. *Threshing and cleaning.*—The threshing is now done everywhere by horse or steam power. The only point for the farmer to consider is whether it is better to employ an eight-horse power thresher, or the smaller two-horse power. The larger are now mostly used, but there are many considerations favoring the smaller in localities where the wheat crop is not very large. The time between the hay harvest and for sowing wheat is generally employed in threshing, and a number of neighbors associate together sufficient to attend the larger thresher. This is in the most oppressive part of the year on account of heat, and the strength of the farmer is exhausted by the labor of the harvest. It interferes with ploughing for the wheat crop, and the August rains cannot be taken advantage of for this purpose. If farmers generally had a two-horse power the threshing could be done after the wheat crop was put in. Besides, these two-horse powers would be useful in many other operations of the farmer—in grinding meal, stock feed, in pressing sorghum, sawing wood, &c. But in districts where large crops are raised, as in the prairies, the larger thresher must be used, that the work may be well done. The best threshers, like the best reapers, are those that are made best. *Cleaning* the wheat after its threshing is almost obsolete. The threshers clean very imperfectly, leaving in the wheat much cockle, cheat, and smut. The want of discrimination among buyers has led the farmer to market his wheat as it comes from the thresher. But this is now slowly changing, and buyers are beginning to see that cheat does not turn to wheat. A good winnowing mill must soon be once more in every farmer's barn, and the wheat carefully cleaned. It should be kept so, especially from mice and rats. A corn and wheat granary should be on every farm, built on posts, which should be tinned or covered with sheet iron, with projecting tops of the same material in the form of inverted basins, and the whole well painted.

5. *The proper place to stack the straw and how it should be disposed of.*—When a farmer selects the place to stack his wheat, he ought to have two purposes in view—to feed the straw to his stock, and to increase the amount of manure. As now generally used, the first only of these objects is accomplished. The extent to which straw is used as food may be seen from the

census report for 1860. Turning to the columns of hay and of animals using it, we see the increase of hay is 38 per centum, whilst of horses it is 41, of cattle 94, and of mules 100. Here is a great disproportion between hay food and the animals eating it. That cut up corn has largely increased as a foddering substance is very certain. Still a great and a general reliance is placed on the straw pile. I know of no farmer that does not make this use of it. Its nutritious value is much less than that of good hay, but it costs much less, and it keeps stock in much healthier condition than when fed on timothy hay alone. The farmer who values manure as he should, will always provide stalls for his horses, mules, and cattle, that he may keep them sheltered and save their manure. In these he should feed his hay and corn fodder during the nights and mornings. At 10 o'clock all ought to be turned into the barnyard for exercise, sunlight, and water, until evening; and during this time they should have free access to the straw pile. A good deal of it will be wasted, but, before stalling them for the night, this waste should be forked into the stable for bedding and manure. Hence the proper place of stacking the straw pile is in the barnyard contiguous to the stalls. But in order to save some hauling, a very different place is generally chosen. It is stacked in the field where it was grown, or in an adjoining clover or grass field, and the stock suffered to trample fields on which they should not be permitted to go. To avoid this, as some do, it is stacked in a piece of woodland. In both cases the waste straw and the manure remain there for years, until the plough again enters the field, when what remains after being leached and washed away, is carelessly spread around. Thus this large source of manure is either entirely lost, or in a great degree, when a little additional hauling would bring it to the barnyard, where it might be fed and used as stated. In order that we may see the value of straw as a manure, I give the following table of the ash analysis of 10 bushels of grain and 1,200 pounds of straw, the amount usually allowed for the production of that number of bushels of wheat.

	10 bushels of wheat.	1,200 pounds of straw.
Potash	2.86	8.97
Soda	1.04	.12
Lime	.34	4.84
Magnesia	1.46	2.76
Oxide of iron	.08	.94
Sulphuric acid	.03	4.20
Phosphoric acid	6.01	2.22
Chlorine	"	.79
Silica	.14	47.16
	12 pounds.	72 pounds.

This analysis shows how large an amount of silica is in the straw, a mineral element so necessary to making a strong, bright, and healthy stem, that can resist the winds and storms. When stock consumes the straw, silica does not enter into the composition of their bodies, consequently it is passed off with the manure. By saving both straw and manure, all this silica is returned to the fields. It will be seen that the straw contains about three times the amount of potash, lime, magnesia, and sulphuric acid that the grain does, and that it has a large proportion of phosphoric acid, one of the most essential elements of wheat. These elements of the straw are too valuable to be so lightly regarded by most farmers.

Having thus, I believe, considered all material matters connected with the growth of the wheat plant, my task is accomplished.

WHEAT-GROWING IN NEW HAMPSHIRE.

BY LEVI BARTLETT, WARNER, NEW HAMPSHIRE.

It has been said, and with much truth, that a failure of the wheat crop in England affects the exchanges of the whole commercial world, and a scarcity in France generally brings about a revolution. The statistics of the last census, in connexion with the official returns of our exports of wheat and flour for the past two years, exhibit some important facts in reference to the vast agricultural and commercial value of the annual wheat crop of the United States. Our foreign exports of wheat, flour, and other breadstuffs, show, too, the dependence of Great Britain, France, and some other foreign countries upon the United States for the "staff of life," in years when the crops of those countries have fallen much below an average; but how much longer we can continue to furnish, for foreign consumption, such enormous amounts of wheat and flour, under the present wasteful system of farming as practiced in too many of our western States, is a question that time alone can answer.

That some sections of our country, from the composition of their soils and climatic influences, are more favorable to the production of wheat than other sections, is undoubtedly true, though these *supposed* unfavorable districts, under judicious and careful cultivation, yield heavy crops of Indian corn, oats, barley, hay, and root crops.

To show that wheat can also be successfully and profitably grown in these same sections is, in part, the object of this communication. A large portion of New England, from the deficiency of lime in the soil, has been thought to be less favorable to the production of wheat than those soils, having a much larger percentage of lime in their composition.

This may be true, but facts, in numbers sufficient to put the matter beyond all cavil, prove that the granite soils of New Hampshire, by the aid of good farm-yard manure and proper preparation of the soil, will, in years favorable to the wheat crop, yield as large an average per acre as is grown in the more (apparently) favored States.

The varieties of spring wheat have been universally grown here till within about a dozen years past, since which time winter wheat has been somewhat largely grown by our farmers. Previous to that time some of them, as I am aware, had attempted its culture, for the general belief was that the plants would not survive our northern winters. In consequence of this belief none but spring wheat was grown, which, till about thirty years ago, was successfully grown, not only upon our hill farms, but also on the intervals and other low-lying lands in the valleys bordering our rivers and smaller streams. But about the year 1830 the fly, the parent of the orange-colored midge, (improperly called weevil,) made its appearance in this vicinity, and soon spread in every direction, committing serious depredations, year after year, upon the wheat crops, to such an extent that its cultivation upon low-lying farms was generally abandoned, and oats, barley, and rye grown instead. In consequence of which, thousands of our farmers have been obliged to purchase western flour to furnish their families with "wheaten bread," and thus the citizens of our State have paid out millions of dollars for wheat and flour the products of other States. The last census returns, however, show that the production of wheat in New Hampshire has been greatly upon the increase within the past ten years.

The census returns of 1850 put down the number of bushels of wheat in the

State at 185,658; that of 1860 at 238,966—being an increase, over that of 1850, of 53,208 bushels. Much of this increase is undoubtedly owing to the extended culture of winter wheat among our farmers within the past few years. Of winter wheat I shall have more to say further on.

During the thirty years that the wheat midge has been among our wheat-fields, the crops on our hill farms have suffered but little from the ravages of the insect, when contrasted with the injury done the crops in the valleys and upon the more level plain lands. The reason why the spring wheat was less injured upon the hills than that at the base of them has been *supposed* to be owing to the greater prevalence of winds sweeping over the elevated lands. The winds, it was thought, interfered with the extensive operations of the almost invisible winged insect that deposits, within the chaff or husk enclosing the kernel, the orange-colored midge.

It is possible that the winds may sometimes interfere with the insects in their attempts to deposit their progeny; and it is quite certain that the almost ever-moving winds upon the hills cause a dryer atmosphere than that in the vallies, and it is said that the insect "cannot endure a dry atmosphere."

In confirmation of the above I quote from a recently published treatise on the "wheat midge," written by Dr. Fitch, the able and widely-known entomologist of New York. He says:

"They (the winged insects) are most active in a moist atmosphere, and cannot endure a dry one; hence they are only seen at their work on the wheat ears in the night time when the dews are falling and on cloudy days; and if the last half of June be wet and showery, this insect is most numerous and destructive, but if it be remarkably dry the wheat that year escapes from injury, the insect withdrawing from it, probably, to the grass of moist low-land meadows and the margins of streams, in which to rear its young, to run, as they do, into the wheat next year."

In another paper by Dr. Fitch on the midge, he says:

"And what could it be that banished this insect from the wheat in 1860 and brought it back in 1861? The remarkable difference in the weather of the two years furnishes an answer to this question. When the midge fly came out to deposit its eggs in June, 1860, the weather was excessively dry; in 1861 it was very wet and showery, and thus we learn the fact that these flies cannot breathe a dry, warm atmosphere; they are forced to retreat to places where the air is damp and moist."

His remarks about the dry weather of June, 1860, I presume, applying to portions of New York, and so of the wet month of June, 1861; but the month of June, 1861, in this section of New Hampshire, was the reverse of "wet and showery." In August of that year I forwarded to the publishers of the Country Gentleman, Albany, New York, a dozen samples of winter wheat which I raised that season. In the letter accompanying the wheat I stated "we had no rain from the first week in June (1861) till into July, and the drought, I presume, somewhat affected the growth of straw and heads, as neither are as long as the same kinds were the previous year." But none of the different kinds, except one or two *very* late ones, were at all impaired by the midge. After the first week in July the weather was "wet and showery," and many fields of spring-sown wheat were very badly injured by the midge.

The above statements seem to go far to corroborate Dr. Fitch's views; but if correct I do not see of what practical benefit it can be to farmers, as none of them can fortell at seed time what the weather of the last half of the month of June will be—whether wet and showery, or dry and windy. Consequently the farmers must commit their seed to the soil when their judgment shall dictate, and trust to the weather as heretofore.

To avoid injury from the ravages of the midge, some farmers, when the season will permit, sow early, sometimes in the latter part of April. In favorable seasons the wheat gets into blossom before the fly makes its appearance, and thus the grain mostly escapes the midge and rust. Others prefer sowing their wheat late, say from the 20th of May till 1st of June, the midge having

generally disappeared before the wheat comes into bloom; but late-sown wheat is more liable to suffer loss from rust, mildew, &c., than the early sown, but of late the midge has not proved so destructive to the wheat crops as formerly. From this fact, and from better manuring of the land, and more care in its preparation for the reception of the seeds, wheat-growing is evidently upon the increase in this State, though much of this increase is derived from the more extended culture of winter wheat within the past ten years. Previous to that time very little was raised. Winter wheat can be grown, yielding good crops, on low-lying farms, where it was useless to attempt the raising of spring wheat, for the reason that the winter wheat would, when sown early, and on suitable soil, get so far advanced in growth before the appearance of the midge fly as to entirely escape its ravages.

THE INTRODUCTION OF WINTER WHEAT INTO THIS SECTION OF NEW HAMPSHIRE.

About a dozen years ago the son of one of our farmers was in western New York, and was so pleased with the appearance of the winter wheat there that he brought home fourteen quarts—all his valise would hold. This was sown early in September on one-third of an acre of light, dry land, from which a crop of oats had been harvested. The oat stubble ground was manured before being ploughed; the wheat sown and harrowed in. Next spring the plants came out bright and green, none being winter-killed, and no injury from midge or rust. The season being favorable, the product or yield was sixteen bushels, or at the rate of forty-eight bushels per acre.

This small patch of winter wheat and its favorable results created quite an excitement among our farmers. Scores of them never before had seen a field of fall sown wheat. All the farmer could spare was readily sold for seed at three dollars per bushel. The results of the several experiments, as made by different farmers, were, as might have been expected, "good, bad, and indifferent." Those sowing as early as the first of September, on suitable soil, realized a yield from sixteen to twenty bushels for the bushel sown, while others that deferred sowing till after their corn was harvested—some time in October—harvested rather light crops, suffering loss by midge, rust, and winter-kill.

Most of these last-named experimenters decided at once that fall-sown wheat could not be grown here. But their failure was not in our soil or climate, but the result of their inexperience and lack of knowledge in the proper culture of winter wheat. I procured a bushel of the farmer above alluded to, and sowed it about the 20th of September, (three weeks too late,) on one hundred rods of light, sandy land, from which a fair crop of field beans had been harvested at the time of sowing the wheat. I applied 125 pounds of Peruvian guano. Some patches were deeply covered by snow drifts, winter-killed. The yield, however, was ten bushels, most of which I sold for seed at three dollars per bushel.

From that time (ten years ago) to the present I have grown winter wheat every year, and without a single failure in raising fair crops. There has been some difference in the acreable yield in different seasons. But on my farm winter wheat has proved a surer crop than either corn, potatoes, or oats. I have grown it on interval or alluvial soil, and on sandy, gravelly, and loamy lands, as also on yellow, loamy, upland rocky soils. I have grown it on inverted timothy sod, on a clover ley, and after oats, and wheat after wheat. I have tried all the above ways and kinds of soil for the purpose (in part) of ascertaining the adaptation of our different soils and climate for raising winter wheat, and have come to the conclusion that fall-sown wheat is as sure a crop in New Hampshire as it is in any other of the States in the Union.

During the time I have experimented with a great variety of wheats from

the Patent Office and other sources; much money has been expended by the Agricultural Division of the Patent Office in the procurement of wheat from foreign countries, and other sources, for distribution among the farmers and planters in the different sections of the country. Some of the varieties from foreign countries, although large and handsome kernels, proved too tender for this northern climate, winter-killing in toto. Other sorts proved half hardy; a few varieties distributed from the Patent Office, foreign and American. have withstood our winters quite well, and proved valuable wheats for cultivation in New Hampshire. One of the hardiest foreign varieties I have experimented with is the Early *Noé* from France.

No. 1, *Early Noé* has a stout, stiff straw, good heads and kernels, is productive and hardy. Its flour makes a good quality of bread—white, sweet, and moist. It is a white, bald variety. The Patent Office Report for 1854 says: "From its hardy and productive nature it is gradually superseding the summer wheat in the high latitude of Paris, and is much sought after on account of its precocity. As this wheat has the property of ripening some days before the common sorts, if it succeeds in our climate in this respect a great point is gained. A single week thus gained in ripening would often secure a crop from injury by fly or rust, aside from the advantages to be gained from an early market." Under my culture the Early Noé has not proved earlier than the White Flint and several other varieties under the same conditions.

Michigan Tuscan wheat.—This variety I received from the Patent Office some five years ago. It was highly recommended in a printed circular (accompanying packages) signed by a number of Michigan farmers. The Tuscan is a white bald variety—a good-sized berry—productive and hardy. It makes a prime quality of flour.

Professor Emmons in his "Classification and Analysis of Wheats," says of the Tuscan bald wheat: "This kind, introduced from Tuscany in 1837, has been laid aside in consequence of its liability to be injured or destroyed by frost. Its flour is fine and white, and its heads well filled." I presume the Tuscan of Michigan is of the same kind as that described by Dr. Emmons, but under my culture it has proved a hardy variety; "its flour fine and white, and its heads well filled."

"*General Harmon's Improved White Flint.*"—Dr. Emmons says this variety is considered by Mr. Harmon as new, having been produced by himself by a selection of the best seed and liming and sowing on a limestone soil. It is larger than the White Flint and yet the cuticle of the kernel is equally thin, delicate and white. It weighs, according to the statement of Mr. Harmon, when prepared for seed, 64 pounds to the bushel. Two bushels and eighteen pounds of this wheat produced 106½ pounds flour and 31 pounds of bran; loss one-half pound.

Some twenty years ago General Harmon sent a quantity of the above-named wheat to the Patent Office for distribution. At that time I received a small sample, but as I knew nothing of the culture of winter wheat I sowed it so late in the season that most of it was destroyed by the midge. After two trials I gave it up, saving what little the midge left, perhaps half a gill or so, which was put in a package properly labelled, where it remained in my seed-box till about seven years ago, when I received six or eight packages of Patent Office wheats. These, with the White Flint, were carefully sown in drills, the Flint yielding the best of the lot. From that small beginning I have every year since raised fair crops and sold many bushels for seed. The crop of 1861 weighed 64 pounds per bushel, making 48 pounds of superior flour. This year it weighs 63 pounds per bushel, making 47½ pounds of flour per bushel, of as good quality as the best western flour, which is worth ten dollars per barrel here at the present time. Four and one quarter bushels will make a barrel of extra flour, thus making the wheat worth a trifle over $2 33 per

bushel, for the coarse flour and bran are worth more than I pay per barrel for flouring, viz: twenty-five cents per barrel. From the foregoing data, our northern farmers can judge whether it is better to raise wheat for family use, or raise other crops and purchase western flour.

White Blue Stem is a variety of bald white wheat, raised to some extent in this vicinity. The heads are rather short, and generally well filled. A few days before the grain ripens a portion of the straw below the head assumes a purplish or bluish color, giving the straw the appearance of rust. This is, I think, an old and well-known variety. What I have grown of it, by way of experiment, was selected from the Michigan Tuscany.

Early Conner wheat.—The seed grown in 1859, near Richmond, Va.; it was harvested June 2, the same year. The sample was forwarded to me by Mr. Harris, of the Genesee Farmer. The seed was sown on light, sandy soil, on the 13th September, 1860, in two drills of about fifty feet in length. The heads of this variety are short, and the grains not very large. It is a white, bald variety, and probably its greatest recommendation is its earliness, being fit to harvest from seven to ten days earlier than the Flint or the "Blue Stem," &c.

Early May.—This variety was forwarded to me by Mr. Killgore, of Fern Leaf, Kentucky. This kind was sown in a drill, side by side with the Early Conner. It appeared to be, in every respect, identical with the Conner wheat. The early May has been grown to some extent by Mr. J. Johnston, near Geneva, N. Y. It proved earlier than some of the kinds usually grown in that section, and it ripens some two weeks earlier in Kentucky than some of the later varieties. Where there is danger of injury to the crop from midge or rust it might be well to grow the Early Conner and the Early May; but I think them less valuable than some other sorts.

Early Japan.—The original seed was brought from Japan by Commodore Perry. It is the earliest wheat I have any knowledge of. I have grown it, in a small way, six or seven years. Some winters it has suffered but very little from winter-kill; in others, when covered with a large body of snow, it has been badly injured, or, as some call it, smothered. The Japan is a dark-red chaff and grain, rather small, round berry. The form of the head differs from any other variety I have grown. From its early maturing quality I thought very favorably of it the few first years I cultivated it, as it was never injured by the midge or rust.

Mr. Klippart, in a note, says: "The isothermal line of Japan is about the same as that of Tennessee." From this it is inferred that it would not be safe to attempt the cultivation of this variety much north of that State; but this variety has generally succeeded in New Hampshire, which undoubtedly is due to the covering of snow.

In August, 1860, I forwarded to Colonel Boyd, Hancock, Maryland, five varieties of winter wheat, which were sown that autumn. In April, 1861, I received a letter from him, saying: "The Early Japan has been unable to stand the severity of the winter, having been almost entirely frozen out;" from which fact he supposes it one of our varieties of spring wheat. The Early Japan has proved a valuable spring wheat in some sections of Maryland.

I do not call in question any of the views, as expressed by Mr. Klippart in his report of 1857, in regard to southern wheat sown in Ohio. But I have grown the Early Conner, of Virginia; Early May, from Kentucky; Lancaster, from Maryland, and a variety from Mississippi, and the red wheat from Japan; all of which have passed through the winters as safely as any of our northern varieties, except Japan, which has sometimes partially failed by smothering; or when the snow disappeared the wheat and ground were overspread with a white, slimy mold, and the Japan, under such conditions, has suffered more than other varieties.

Some varieties of wheat are naturally earlier than others, just as there are early and late varieties of apples, peaches, &c.

Thus the Early Conner ripens ten or twelve days earlier in Virginia than some other varieties; so of the Early May of Kentucky, and they retain the same early maturing quality when grown in New Hampshire, thereby generally escaping injury from the midge and rust, while those sorts from ten to fifteen days later are frequently badly injured by one or both of these scourges of this cereal. A late variety of southern wheat sown in New Hampshire will prove a late variety there. This fact was verified in a small sample of Mississippi wheat I grew the past season.

Wheat grown in warm climates is probably less hardy than that grown in more northern latitudes, and probably much of the wheat imported from warm countries by the Agricultural Division of the Patent Office has failed from lack of hardiness. This has been the case with several varieties I have experimented with, and so with others. In confirmation of the above, I made the following extract from Klippart's report, 1857: "In September, 1855, sowed a package or two of Turkish Flint wheat, mostly winter-killed; harvested a little more than the seed sown; this was sown in September, 1856. It looked well up to the falling of snow; that went off early in February, and every plant was winter-killed, while the Genesee Flint wheat, sown by the side of it, escaped entirely. During the past two seasons, having experimented with five kinds of imported winter wheat received from the Patent Office, I found none of them comparable with the Genesee Flint. I trust, however, that they have done better further south, as some of the samples were very fine. In a note at the bottom of the page Mr. Klippart remarks:

"But even if these varieties were acclimated at the south, and proved excellent varieties, they might not be desirable in Ohio—they certainly would mature and ripen *late*; thus becoming liable to rust, midge, and other maladies incident to late varieties, as well as being liable to *winter-kill*, and otherwise deteriorate."

I do not know but varieties of winter wheat have been procured for distribution among our farmers from some of the northern portions of Europe; if so I have not learned the fact; but my impression is that wheat from Russia, Sweden, Denmark, &c., would prove earlier, hardier, and succeed better in New England than that from warmer and semi-tropical regions.

But to go back to other varieties of winter wheat I have experimented with.

I believe it is thought the red chaffed wheats are hardier and more productive than the finer, white varieties. Of this, however, I am not certain, as all the winter wheats I have seen growing in this vicinity were of the white, bald sorts.

BEARDED WINTER WHEAT.

Lancaster wheat, a bearded variety from Maryland, where, as I learn, it stands high, as a hardy and valuable variety. A. G. Boyd, esq., of Hancock, Maryland, forwarded to me a small sample of the Lancaster wheat. In his letter he says: "The Lancaster wheat, herewith enclosed, is the earliest of our wheats, and is in considerable demand with us for seed. It is somewhat singular in appearance; whole fields, when ripening, presenting the appearance of rust." The envelope enclosing the wheat in some way became rent, and a part of the seed was lost; however, there was just one ounce received. This was sown in drills 1st of September, 1861; harvested last July, yielding twenty ounces for the one sown; not a bad yield for a very wet, showery time, one or two weeks during the ripening season, which caused the straw to rust considerably, and a shrinkage of the kernels.

In August, 1860, I forwarded to Mr. Boyd five varieties of my winter wheat. The next August he wrote to me as follows: "All the varieties of the wheat you sent me last fall, I observe, are smooth, (bald.) There is existing among

our farmers a prejudice against smooth wheats, and I am beginning to be of the opinion that it is not without substantial reasons. Certain it is that our smooth varieties are more subject to the ravages of the fly and other insects, and to the elemental diseases incident to the wheat crop, and yielded little or nothing, whilst the bearded varieties, with but few exceptions, escape the insect and these diseases, and yield remunerative crops."

All the knowledge I have had respecting bearded winter wheat has been derived from the small quantities I have experimented with the two past seasons, and I am of the opinion that in the field culture the bearded varieties may prove the most productive and profitable.

It is generally supposed that clayey soils, having a good percentage of lime in them, are best adapted to wheat raising. This supposition is probably correct, and I am well aware of the great use made of lime in the wheat-growing regions of Pennsylvania, Virginia, and some other States. But the *idea* that wheat can only be grown in a soil containing a large percentage of lime is a very erroneous one. Experiments, ten thousand times repeated, in growing wheat on the silicious and granite soils of New England, which are proverbially deficient in lime, conclusively prove the error of such a belief or idea. Klippart says: "Lime forms less than one pound of the ashes of one thousand pounds of the wheat grain." A soil must be very deficient in lime that could not furnish that percentage to a crop of wheat, even if the yield should reach fifty bushels per acre.

In the New York State Agricultural Society Transactions, 1861, I find a very interesting account of the agriculture of Chester county, Pennsylvania, by L. H. Tucker, junior editor of the Country Gentleman, Albany, N. Y. He says: "That lime is largely used by many of the farmers of that county," it being a limestone region. In speaking of the farm of Richard J. Downing, esq., he says: "Mr. D. burns 1,400 bushels at one burning, which Mr. D. computes to cost him for quarrying and all, performing the work as he does with his own teams, &c., *only four cents a bushel.*" No doubt, our New England farmers would also use lime largely upon their land, if they could procure it "*at four cents a bushel;*" but here we are differently situated in this respect. All our lime for the mortar used in laying the brick for buildings, chimneys, and forming the walls of our rooms, comes from Thomaston, and one or two other points, in the State of Maine. It is freighted by water from the kilns to Boston, and from there to this place by railroad, (80 miles,) costing here $1 50 per barrel, or about 60 cents per bushel for the burned limestone. At this price our farmers do not think it will *pay* to lime their lands. If we could *only* raise wheat by the free use of lime upon our soils, we should truly be in a bad fix. But, fortunately for us, farm-yard manure contains all the necessary constituents for the wheat crops.

Mr. Tucker says there is no spring wheat grown in Chester county. He saw much winter wheat growing, (as he was there in the month of June.) Some of the best fields on the limed lands, he thought, would yield from 30 to 35 bushels per acre.

In the Patent Office Report, 1861, there are a dozen pages on "Farming in the New England States," by James S. Grinnell, of Greenfield, Massachusetts. In speaking of wheat, he says: "The wheat crop is annually increasing. The average for New England being at the rate of 15 bushels per acre. During the present season (1861) 40 and 50 bushels to the acre have been frequently raised in Massachusetts. A like yield has been obtained in the valley of the Connecticut, in the States of New Hampshire and Vermont."

By the late census returns it appears that the wheat crop in New Hampshire and Massachusetts in 1850 amounted to 216,869 bushels. The return of 1860 puts down the number of bushels at 358,749, being an increase in ten years of 141,880 bushels. Much of the land upon which the above-named wheat was

grown has been under cultivation from one hundred to two hundred years, and I very much doubt whether it would average a bushel of lime per acre, that has been directly applied to these lands since they were cleared of their forest growth.

SMUT AND CHESS.

"As ye sow, so shall ye reap." If the farmer sows smutty wheat, he will be pretty sure to reap smutty wheat. If he sows chess seed with his wheat, he will be quite likely to harvest a mixture of wheat and chess.

In my experience with a great variety of wheats, starting at first with a small quantity of pure seed and threshing it with flail, I have never found a single stalk of chess. But after growing the several kinds in quantity sufficient to thresh in machines propelled by horse or water power, and having had my pure wheat threshed immediately after wheat grown by others containing chess, I have sometimes found a few plants of chess among the standing wheat when harvested. But to my view the chess was derived from chess seed. In my humble opinion it is quite as absurd to suppose that wheat changes to chess "as it would be for a serpent to become a clam or an oyster, and this clam to subsequently change into a bird."

After having experimented in several ways in preparing the land for wheat, I have given what I have found to be the better way. If I sow after clover, mow the first crop early, or while in blossom. Between the 20th of August and the 6th of September, with a good plough, completely invert the sod, burying the second crop of clover, as far as possible; then pass a heavy roller over the inverted sod, which closely packs the furrow slices, facilitates the cartage of the manure over the land, and prevents tearing up the sod in the after culture of the cultivator or the harrow. Apply from 12 to 20 cart loads of manure per acre, using a large, heavy cultivator (Buchlin's patent) in burying the manure and pulverizing the soil. Sow about one bushel seed to 100 rods of land. Generally wash the seed, before sowing, in a strong brine, and after draining, dry, or separate the wheat, by mixing newly-slacked lime with it. When I have thus washed and limed the seed, I have never harvested smutty wheat, while some of our farmers who have sown *unwashed* seed have some years reaped very smutty crops.

What is universally understood in this section of the country as *smutty wheat* is that diseased state of the grain when the entire kernels of a portion of the heads, instead of containing flour, are filled with a kind of lampblack substance, which, upon being rubbed between the finger and thumb, "emits an unpleasant odor resembling that of the sea, or of spoiled fish." It is the *uredo caries* of De Candolle. In France it is known as *ble noir* (black wheat.) If smutty wheat is threshed in a machine and then perfectly clean wheat is threshed, this will become infected and will produce smutty wheat, if not washed, limed, &c.

I sometimes roll the ground after sowing—at other times have not. The grain is surer to come up where the roller is used to "finish off." Some good farmers object to the use of the roller after the wheat is harrowed in. I generally sow timothy seed with the wheat, and clover in the following April, and have never failed in obtaining good crops of grass in this way.

In preparing the land for the crops, if a timothy sod, oat or wheat stubble, pursue the same course as pointed out in the treatment of a clover ley. I have found it better to apply the manure on the inverted furrows than to plough it under.

I have never sown wheat after corn, because I could not remove the corn in season to sow as early as I wish. Some of our farmers have sown after removing the corn crop, but such late sown is more liable to winter-kill, midge, and rust, than that sown 1st of September, nor have I ever fallowed the land (by several previous ploughings, &c.) because I have grown quite satisfactory crops with

one ploughing. The use of summer fallows is being dispensed with where formerly much practiced. In an address by the Hon. George Geddes, president of the New York State Agricultural Society, at its annual meeting, Albany, February, 1862, in speaking of the improvements in the plough, he says: "With these advances the old-fashioned summer fallow has nearly gone out of use, except to kill some noxious weeds. One good ploughing, eight or nine inches deep, is now the order of the day, and has generally taken the place of three scratchings of the surface, practiced aforetime."

In those sections of the country where the wheat is liable to injury by the Hessian fly the wheat sown last of August or first of September is liable to injury from the ravages of this fly. To guard against this, later sowing is required, as late or later than the 20th of September. Fortunately, the Hessian fly has not yet injured our wheat crops. If it should visit us in large numbers we must practice late sowing, and risk winter-killing, midge, and rust.

It is said that "every man thinks his own geese swans." I may be over sanguine in regard to the growing of winter wheat at the north, but my experience in this matter justifies me in the belief that it would be for the interest of the farmers of the "old granite State" to raise more wheat and purchase less western flour.

COTTON.

THE sceptre of King Cotton is wrested from him! The royal prerogative was sacrificed through the reckless passion and insane folly of his friends. Yet it is right: he never was entitled to the distinction. First useful, then influential, then powerful, he became inflated with insufferable vanity, and odious with intolerable arrogance. Profiting by the lesson, reduced to his natural position, he may again become useful, perhaps travel north a little, and act in a circle less circumscribed by prejudice and that "vaulting ambition" that so often overleaps itself.

WHAT COTTON IS AND WHERE IT GROWS.

The plant producing the downy fibre attached to its seeds, which has recently come into use so nearly universal for the various purposes of clothing, is of the same family as the common mallow; botanically considered, of the order *malvaceæ*, of the genus *gossypium*, of which the species, as modified by cultivation, are somewhat uncertain in their classification, the principal being *herbaceum*, (the green-seed upland of the southern States,) *hirsutum*, (the shrub cotton,) and *arboreum*, (tree cotton.) The cotton of Peru and South America generally is the *hirsutum*, growing bushy and stout, and living several years in temperate climates destitute of frost. The tree variety is from fifteen to twenty feet in height, and is found in the East Indies, growing wild, and in South America, the staple long, strong, silky, and yellowish. There is so much variety, in different climates and latitudes, in the size and habit of the plant, the color of the flower and of the seed, the quality of the fibre, and other points of difference, that confusion arises in the classifications of botanists in different quarters of the globe.

Much the larger proportion of cotton grown is produced in this country. Seven-eighths of the entire product of the world, it has been estimated, has been reached by our increased production. The East Indies occupy the next place, followed by South America, (Brazil mainly,) the West Indies, and Africa.

It has been used for the manufacture of cloth more than two thousand years, being first known in India, then introduced into Greece and the countries of the Mediterranean. It is now found in all tropical latitudes, and adjacent temperate localities in the United States south of 35°; in the West Indies; in South America down to Peru; in the Pacific isles; in Australia, Japan, India, and China, and in nearly all explored portions of Africa.

ITS CLIMATE.

The cotton plant is a child of the sun, flourishing under ardent skies, growing with superior luxuriance in dry seasons, and withering under the influence of a soaking subsoil and long-continued storms. In latitude 30° to 32° in this country, upon the proper soils, it luxuriates in its greatest vigor. It delights not in an arid, brazen sky, but in an unobscured sun by day and copious dews at night—abundant moisture with continuous sunlight in its season.

It is such a climate that suits cotton, and not that the plant is of a salamander species, needing no moisture. It is on this account, quite as much as the quality of the soil, that the best alluvium of the Mississippi, bathed in an atmosphere filled with moisture, without clouds to obscure the sunlight, is so productive of cotton.

North Carolina, a poor cotton region, is the northern limit of profitable culture, at former prices, on the Atlantic coast. The bottom lands of Tennessee, and the district between the Tennessee and Mississippi, comprise the boundaries in that direction. When the fibre sells at sixty cents to one dollar per pound, there is an inducement to encounter greater climatic risks, and accept smaller and more uncertain returns. It is, therefore, planted, at the present time, to a considerable extent, in more northern latitudes, in soils deemed most suitable—in Kentucky, in Missouri, somewhat largely in Kansas, in southern Illinois and Indiana, on the eastern shore of Maryland, and in southern Delaware. There is a possibility of ripening, under favorable circumstances, up to 40° north latitude, with success sufficient to tempt experiment when the fibre approaches its present commercial figure.

The United States census for 1850 gave the average product per acre in unginned cotton, by States, as follows:

Florida	250 pounds.	Louisiana	550 pounds.
Tennessee	300 "	Mississippi	650 "
South Carolina	320 "	Arkansas	700 "
Georgia	500 "	Texas	750 "
Alabama	525 "		

This statement shows the difference in soil, and the effects of wasteful culture in the older States; but it shows most conspicuously, also, the influence of climate, especially in the figures for South Carolina and Tennessee.

THE BEST COTTON SOIL.

The selection of a proper soil is a vital consideration in cotton culture—a consideration that must not be ignored in the present attempt to extend the bounds of its production. While the soil, in its quality and condition, should be good, it need not necessarily be very rich either in mineral or organic elements. Some of the richest soils (other conditions being unfavorable) produce only medium crops. A predominant ingredient of the best is silex, and yet a soil of coarse sand, weak in elements of the stalk, seed, and fibre, is the poorest of cotton soils. Few cotton soils have less than eighty per cent. of silex, and many have ninety, a fine specimen from a Georgia sea island plantation having ninety-two. But the silex should be so fine as to seem destitute of grit.

It is thought by many that those prairies composed mainly of decayed vegetation, which dry out with a few days sun, are just the places for cotton.

There could scarcely be worse. The Mississippi bottoms are, indeed, among the best cotton lands in the world; but they are composed largely of sand, fine as the silt of the ocean's bed, retentive of moisture, and overspread with an atmosphere dripping with dews at night.

It will readily be seen that cotton is not a very exhaustive crop, when it is remembered that the stalk and leaves are never taken from the field; that the seed is returned to it, and only three hundred pounds of fibre (much more than the average) are taken from an acre. As the ash is only one and a half per cent., but four and a half pounds are abstracted from the soil. According to Johnston, 25 bushels of wheat abstract 17.65 pounds of mineral matter; 38 bushels of barley, 46.98 pounds; 50 bushels oats, 58.05 pounds; while potatoes average more than 150 pounds; and beets, with their leaves, three times as much to the acre. Cotton is comparatively exhausting as a crop when the seed is not returned to the soil. The seed constitutes fully sixty per cent. of the weight of unginned or "seed cotton," and contains, according to Mallet, twice as much potash (which is the principal mineral ingredient) as the fibre. A very large proportion of the potash in seed cotton is thus contained in the seed, and can be returned to the soil.

The proper degree of moisture necessary is a question upon which planters differ, but the difference is mainly resultant from different circumstances. One has a quick, thirsting soil; he thinks cotton needs a great deal of water. Another has a tenacious clay, with a subsoil always saturated with water; he affirms strenuously that cotton requires little or no rain. Dry seasons have been observed to be those of large cotton crops; yet very light, sandy soils, under continued drought, produce little, while stiffer alluvion and prairie do well. These facts, apparently contradictory, have confused the ideas of superficial thinkers; some asserting that the cotton plant needs large supplies of moisture, others declaring that it does not. The truth is, *it does need constant moisture, and at the same time perfect drainage and daily sunlight.* It delights in a soil that can seize, hold, and appropriate the heavy dews of the cotton latitude, and obviate any urgent necessity for the showers of heaven. A soil not peculiarly retentive of moisture, otherwise rich, needs frequent showers to perfect the plant; but a clay subsoil, saturated with long continued rains, is destructive of the planter's hopes. Difference in soil, therefore, fully accounts for these superficial opinions, so widely differing. "Not rain, but moisture, is essential."

Cotton has a long tap root, two or three feet in length, in good soil, sometimes four or five, with a mass of fibrous side roots. It thus finds moisture, and diffuses freshness through the plant, which smiles a welcome to the grateful beverage. The natural habitat of cotton is the home of moisture-loving plants, such as the dwarf palmetto and Spanish moss. On such lands the fibre is longer and heavier than on dry, sandy soils.

The very perfection of cotton soil may be said to be the cane-brakes of Central Alabama and the rotten limestone region of Mississippi—both essentially the same, and both underlaid by a soft, yellowish-white limestone of the tenacity of dense chalk, containing about seventy-six per cent. of carbonate of lime; yet the superincumbent soil contains only a minute proportion of lime, with potash, soda, and magnesia.

This soil is remarkable for the fine state of comminution in which it is found. Its minuteness of subdivision is extraordinary—with no stones or gravel, and few particles larger than one-fortieth of an inch in diameter, giving an enormous surface of these atoms in proportion to mass or quantity. It is so fine as almost to seem impalpable dust when dry; remains long in solution without deposition; contains, moderately dry, one-third weight of water, and nearly one-sixth when air-dried; in the heats of summer it becomes hard, and in roads polishes with friction, while in the rainy season it is a stiff, plastic mud; its cohesion is twice

as great as that of common clays or pine-woods sandy loam; its adhesive power is in still greater excess; it attains a higher temperature and cools more slowly than other soils; water percolates through it less rapidly; its capillary power acts more slowly, but with longer duration, bringing water from greater depths and raising a given quantity to a higher altitude; absorbs aqueous vapor more tardily, but one hundred per cent. more in quantity than clay or light sand; and has an astonishing power of absorbing ammonia, condensing more than fifty times its volume of ammoniacal gas. Such are the rotten limestone soils, in so fine and uniform division, that the irregular rains of the season are better held and appropriated than in any other. These facts are patent to all who have seen the soil and its produce, and long known, from personal observation, of the writer, but have been made singularly conspicuous by recent experiments of Dr. Mallet, of Alabama, in comparison with other cotton soils. This brief description, could it be extended, might glow in a stronger light, with the aid of the results of these experiments, in their illustrated details; as it is, it will aid in the work of selecting a suitable northern soil for experiments in cotton growing.

In the cotton States there are the following soils on which the staple is grown:

1. The region underlaid by rocks of the cretaceous system in Georgia, Alabama, and Mississippi—the soft, argillaceous limestone.

2. The sea island cotton belt, very narrow, lying along the coasts of South Carolina, Georgia, and part of Florida, and overlying tertiary deposits. The favorite soil of this peculiar product looks like a mixture of dark gray sand and charcoal dust—a sort of lignite or peaty powder, intermixed with shells, wood, twigs, and leaves. The following is an analysis of a sample:

Silica	92.040
Alumina	1.500
Lime	280
Magnesia	370
Potash	1.000
Soda	500
Peroxide iron and oxide magnesia	1.500
Vegetable matter	2.400

With traces of carbonic, phosphoric, humic, ond other acids.

3. Sandy soils underlaid by metamorphic rocks, sandstones, and chertz limestones.

4. Rich, alluvial bottom lands.

These brief suggestions may serve as a guide in the selection of lands foı cotton-growing. Those prairie soils that are very light, and dry readily on the surface, or that are deficient in under drainage, or are composed mainly of decayed vegetable organisms, are not to be selected. If deeply drained, and composed of deposits of drifting sand, with requisite quantities of clay, potash, iron, and manganese oxides, a little lime, and a small percentage of vegetable matter, alluvial prairie will do very well.

Too much vegetable matter will cause a vigorous growth of stalk and leaves, and a meagre amount of fibre, or none at all, should frosts come early in the autumn. Those prairies, so often seen in the west, black with several feet in depth of half decomposed vegetation, if crude, wet, and sour, will not even grow stalk and leaves; if warm, and well suited to the culture of corn, it may grow plants of prodigious size, but no cotton.

In a flooded subsoil the tap-root will not penetrate, the plant becomes sickly, the bolls refuse to open, and scab and rot, and destructive insects make their appearance, and join in crushing every hope of a crop, or even a vestige of one.

In fine, select a soil prominently silicious and aluminous, with a little organic

and mineral matter, such as is needed by the plant for food, all of great uniformity and in minute division. The best is a dark-colored, warm, finely-comminuted upland, or a second bottom, in some cases, with mineral constituents in proper proportion.

PREPARATION OF THE SOIL.

After the selection of a soil deemed most suitable, its proper preparation is even a more vital consideration in northern than in more favorable latitudes. A deficiency in minuteness of mechanical subdivision of particles may be remedied in part by plough and hoe.

Lands should be deeply and thoroughly ploughed long enough before planting to allow the spring rains to settle the soil. If not ploughed previously, particular pains should be taken to secure uniform and deep pulverization. If rough and full of clods, the harrow should follow the plough.

The usual practice among successful cultivators is to form beds with the turning plough, as foundations for the ridges, turning furrows both ways toward the centres.

Ridge planting is almost universally practiced; yet the custom of planting in hills, as with corn, has obtained in certain districts in Virginia and lower Maryland, and may be preferable in otherwise suitable lands that are inclined to be too moist and cold, giving a better exposure of the fibrous side roots to the action of the sun. An increased elevation given to the ridge has essentially the same effect.

If land has been fallow, or in sod, it should first be thoroughly broken up with a heavy plough, and then bedded with a smaller one, harrowing after the first ploughing. This not only pulverizes thoroughly, but leaves grass and weeds far beneath the surface. It will not do to slight the work at this stage; the success of the crop depends upon its character. If done well, half the battle of the season is over.

When the ridge is ready to open for seeding, great care should be taken to get a perfectly straight furrow, to facilitate "scraping out" superfluous cotton and grass. A very light and narrow plough should be used, making a furrow not exceeding an inch in depth. Unless the soil is very light and dry, the seed should not be covered half an inch. A wooden instrument for making the seed bed is frequently used to advantage instead of a plough.

An exercise of common inventive ingenuity would construct a machine for opening, dropping seed, and covering, all at the same operation.

The distance between ridges and between the plants must depend upon the probable size of the plants, which varies from eighteen inches to half as many feet in height. The largest yield is secured by so graduating the distance that the plants will cover the ground and slightly interlock their branches. In good soils the ridges should be four feet apart, and the plants fifteen inches; in lighter, three and a half, and twelve inches; in very rich lands the ridges might be four and a half feet, and the plants fifteen to eighteen inches. This direction is for good cotton soils. If a stinted growth only is expected, plants may be set nearer; some of our amateur planters think six inches will do, but counsels so extreme should not be heeded.

PLANTING AND CULTURE.

Planting in the north should commence as early as is compatible with the safety of the plant, which is very tender at first, but when well rooted is hardy as corn. Seed should be used at the rate of thirty pounds per acre when seed is abundant. A less quantity may do if the distance between the plants is regulated by a dibble, and three or four seeds dropped in each spot so marked, care being taken not to cover too deep.

It has been usual in the south to put in half a dozen bushels of seed per

acre, partly to secure a "stand," and partly to manure the crop. There is a disadvantage in sowing so thick. The plants are thus crowded, as in a hot bed, and are tender and puny. This drawback, with the present scarcity of seed, makes such a course very undesirable in northern latitudes.

The seed should be soaked in a brine made by soaking stable manure in salt and water, and dried with lime, plaster, or ashes. It is more necessary to secure early germination and a vigorous first growth, where the season is short, than in the south.

The plant will make its appearance in about ten days after planting, if the weather is favorable. With too early planting, a cold storm succeeding, there is danger that the seed will rot. It should be put in as soon after corn as possible, looking only at the danger from frost and from failure in germination.

As soon as the third leaf appears the process of "scraping" commences, which consists of clearing the ridge, with hoes, of superfluous plants and all weeds and grass; after which narrow ploughs, known as "bull-tongue" ploughs, turn a little loose earth around the plant, and cover up any grass not totally destroyed by the hoes. If the surface is very rough, (as it will not be with sufficient ploughing and harrowing,) the hoes follow, instead of precede the ploughs, to unearth those plants that may be partially covered. Some experimenters have reported that with them hoes are not necessary. That may be if their lands can be kept perfectly clean with ploughing, which must be done with such skill and care as never to touch the plants or cover them with earth. But if they depend on such culture as corn endures, producing weeds breast high in tangled masses, and an abundant crop of corn besides, their disappointment will be bitter—and deserved.

The negroes of the cotton States often acquire great skill in these operations, running ploughs within two inches of the stalks, and striking down weeds within half an inch with their hoes, very rarely touching even a leaf of cotton.

Subsequent ploughing, alternating with hoeing, (not to hill up, but to keep down the weeds,) usually occurs once in twenty days. For higher latitudes the soil should be worked once in two weeks, or, better still, every ten days, in the early part of the season, to induce rapid growth and early maturity; and the crop should be "laid by" very early, if clean of weeds. The object of working often, however, is quite as much to destroy the grass as to stir the soil, although light surface culture facilitates rapid growth.

There is danger, in deep ploughing, of injuring the roots. It should, therefore, be avoided, except in the middles of the rows, in wet seasons, when it is necessary to bury and more effectually to kill the grass. The slovenly, dilatory planter of cotton is liable to be, in technical parlance, "in the grass," a condition securing the commiseration of more industrious neighbors, and awaking his own apprehensions for the safety and profit of the crop. Nothing is more intolerant than King Cotton of the least encroachment upon his domain. Nothing, as a field crop, demands a cleaner culture.

A great variety of implements is used for this culture, according to differing circumstances of soil and season, and, possibly, the whims of planters. Among them are "sweeps," "shovel" ploughs, occasionally turning ploughs, cultivators, and harrows.

It requires four months for cotton to attain its growth under the most favorable conditions. It is usually planted about the 1st of April in the Gulf States, or from March 20 to April 10, blooms about the 1st of June, and the first bolls open about the 15th of August, when the first picking commences as soon as fifty pounds per hand can be gathered daily.

The blooms come out in the morning, are developed fully by noon, when they are a pure white. Soon after meridian they begin to exhibit reddish streaks, and the next morning are a clear pink. They fall off by noon of the second day. The sea island variety is yellow at first.

If weeds and grass abound, late ploughing is of doubtful utility. An early "laying by" of the crop is probably more important in the north, than in the Gulf States, to stop the growth of the plant and develop the bolls, which continue to form until the time of frost. In the most favorable localities the frost will always kill many immature or partly developed bolls.

To secure the development and maturity of the fibre, it is also recommended to top the plant as soon as ploughing is over, and it has attained its growth.

RESULT OF THE EXPERIMENT.

The experiment in cotton-growing, in 1862, north of its accustomed limits, was important, rather as an indication of possible future accomplishments, than on account of the cotton actually produced, which was in small quantities, of short staple, and much of it immature. It was planted in more southern localities, wherever the limited facilities for seed could be made available, with reference to a crop; it was also planted, where crops could never be expected, in small patches and in gardens, with little knowledge of its proper culture, and generally neglected. Out of curiosity it was grown thus from Maine to Minnesota, with utter disregard of latitude, soil, or time of planting.

The Tennessee specimen of seed distributed was best suited to the experiment. The Georgia seed flourished generally, but required quite too long a season to perfect it. The Chinese gave no satisfaction, most of it failing to germinate.

Some seed of the Peru cotton, received through the State Department and our minister to England, was distributed with the rest. This is a variety of *gossypium hirsutum,* or shrub cotton, living as a perennial (for six or eight years) in a climate destitute of frost. It is a sort of cousin of the sea island variety, and has the same yellowish color, but is no more suited to our rough, northern climate than the banana or orange. It was planted, came up, throve famously, but showed in no instance either boll or flower. It excited great expectations by its vigorous growth, only to disappoint them by its perennial habit. The uniform report is in harmony with the following: "The Peru cotton came up and grew vigorously till frost. It produced an exceedingly large and luxuriant stalk and branches, and that was all; it neither bolled nor bloomed, for the simple reason that it had not time."

In Kansas and Southern Illinois some attempts at field culture were made, with a success proportioned to a knowledge of the proper soil and culture and faithfulness and industry in conducting the experiment. When entered into by persons acquainted with the conditions of success, it was fairly proven that enormous profits may be the reward of him who wins it, and that the goal may be easily reached. With a proper location and soil, a suitable preparation, followed by intelligent and persistent labor in cultivation, the success achieved was gratifying, even flattering, giving assurances that at present prices cotton-growing is the most lucrative business in which the agriculturist can engage.

Not a word of encouragement, as was to be expected, is given by correspondents north of the latitude of 40°. It is useless to attempt to force nature in the production of a field crop. A few puny, half-grown bolls are seized by the frost, and, in the agony of dissolution, their shrivelled substance opens and discloses a meagre quantity of immature fibre. From Champaign county, Illinois, through which the 40th parallel runs, it is reported that up to October 20, the date of the first frost, no bolls were open, and yet a sufficient quantity came out after frost to pay the expense of cultivation.

It was a very common mistake to plant in the richest prairies, by which large stalks and vigorous foliage were produced in abundance. In such cases it was no disappointment to learn that the "heavy rains of September and

October appeared to give the crop an unusual growth of foliage without maturing it."

A greater success was obtained in Kansas than elsewhere, which has led to extensive planting this season. The facts range even there from decided success to positive failure.

At a meeting in Lyons county, in Kansas, called to consider the cotton question, at which many facts were elicited and former experiments canvassed, the opinion was concurred in that 1,500 pounds of unginned cotton could easily be grown to the acre. Instances are produced in which a higher rate of yield has been obtained. At Cresco, Anderson county, a product of 300 pounds of clean cotton per acre was secured at an expense of twenty-five dollars per acre.

Domestic manufactures of home-grown cotton are already exhibited in Kansas; her merchants have commenced the purchase and shipment of the raw product, and quite a furor for its culture and manufacture has arisen.

From Clay county, Indiana, it is reported that the plants did not mature in consequence of a wet season. As the experiment was made on "flat land," and as other correspondents attributed failure to a dry season, there is a reasonable suspicion that the subsoil was flooded and the tap-root drowned out, especially as the writer acknowledges that years ago he had "seen beautiful fields of cotton on the sandy prairie."

A manufacturer in Wilmington, Delaware, with some seed from Southern Virginia, started his plants in a hot bed, and set them out about the middle of May in a poor clay loam. They grew to the height of five feet, producing good, strong fibre, "quite as good cotton as the manufacturers in these parts commonly use."

Thirty years ago cotton was grown in the Wabash valley, and throughout Southern Indiana, to such extent that cotton gins were demanded and provided, at first of a rude construction, consisting simply of smooth wooden rollers, afterwards more pretentious in style and effective in action.

Cotton has been grown in Missouri, to a limited extent, for several years past, with ordinary cultivation and with good success, while prices were less than one-fourth the present figures. W. H. Horner, writing upon cotton-growing in this State, estimates the average yield, with common culture, at 1,500 pounds seed cotton per acre. One hand will work ten acres in cotton and five in corn, producing 15,000 pounds seed cotton and 250 bushels of corn, costing $210, including cotton-picking; and one hand will work twenty acres in corn, producing 1,000 bushels, at a cost of $190. The corn, at twenty-five cents per bushel, produces $250, and a profit of $90 in one case; in the other, the net profit, at present prices, is more than ten-fold.

The planting in Missouri is done near the last of April, and blossoms are produced by the last of June. Care is taken not to stimulate the growth of the plant in the latter part of the season, as it prevents the formation and development of bolls.

On the eastern shore of Maryland, where cotton was produced long before the war of the revolution, the old wheat and tobacco fields promise this year to be white with cotton. A considerable breadth has been seeded, and will be cultivated with something of skill and assiduity. The experiment, scarcely inaugurated last year, will have a much fairer and more decisive trial in the present. May it prove successful, and show that most improbable things are quite possible to skill and labor!

STATISTICS.

The recent increase in the cotton product of the world has been astonishing Little was exported or produced in the United States prior to 1795. It is said that, in 1784, an American vessel, having seventy-one bags of cotton on board,

was seized at Liverpool, on the plea that so large an amount of cotton could not have been produced in the United States. And when an old planter obtained fifteen small bales from five acres, it was not thought strange that he exclaimed, "Well, well, I have done with cotton; here is enough to make stockings for all the people of America." In 1791 the export was the meagre item of 189,316 pounds, or less than 5,000 bales; in 1800 it had reached 17,789,803 pounds; in 1860, 1,767,686,338 pounds, or 3,812,345 bales.

So rapid has been the extension of cotton growing and manufacturing, that an enormous figure has been reached in cotton production. In 1850 the supply of the principal manufactories of the world was estimated as follows:

Great Britain	1,513,000	bales.*
United States	487,800	"
France	369,300	"
Russia	125,200	"
Trieste and Austria	125,200	"
Hamburg and Bremen	70,700	"
Holland and Belgium	71,700	"
Spain	80,400	"
Italy, Sweden, &c.	52,100	"
Total	2,895,400	"

It will be seen that Great Britain used a little more than half. During the entire progress of the improvement of the last generation in cotton manufacturing, that country has maintained very nearly the same proportion, viz: fifty per cent. of the consumption of the world.

The production of the world in 1856 was estimated as follows:

West Indies	4,090	bales.
Brazil	5,500	"
Egypt	86,445	"
East Indies	445,637	"
Total outside of the United States	541,672	"
United States	3,880,580	"
Grand total	4,422,252	"

In 1860 the product of the United States was 5,198,077; other cotton-producing countries swelled the aggregate to nearly 6,000,000 bales.

This production, the sum total of the cotton of commerce wrought by the factories of the world, does not include that used in the domestic manufactures of the natives of India and other semi-barbarous cotton countries, which is wildly guessed at in the computations of English statisticians, and made equal to the entire product of the manufactories.

In 1860 our exports were as follows in quantity and price:

Countries.	Bales.	Average price per pound.
England	3,037,762	10.60 cents.
France	709,918	11.25 "
Other countries	671,535	
Total	4,419,215	10.80 "

* Four hundred pounds to the bale.

The United States consumed 910,090 bales in 1860, or nearly one million bales; Great Britain the same year consumed about three and a half millions.

For twenty years past Great Britain has received from fifty to sixty per cent. of our crop.

The crop of the United States has been equivalent to seven-eighths of the production of the world; and the manufactories of the United States have attained a consumption of nearly one-fifth, or twenty per cent. of this crop.

There is, of course, little importation of cotton into this country—amounting, in 1860, to $140,387, from the British West Indies and Hayti mainly.

Our own manufactures of cotton goods, in 1860, were valued at $115,137,926; the imports of manufactured cottons were $32,559,024; the exports, $10,934,796. This left for consumption $136,762,154.

The European cotton mills had so increased their facilities up to 1860 that they were able to use 100,000 bales weekly, or more than five millions of bales, or five-sixths of the entire production of the world.

Of the cotton imports into England, those from this country were fifty-two per cent. of the total in 1820; seventy-two per cent. in 1830; seventy-seven in 1840; sixty-seven in 1850; in 1860 eighty per cent.

The exports of manufactured cottons from Great Britain, in 1860, were a little over £50,000,000, or about $250,000,000.

The following is a statement of the imports of cotton into Great Britain in the years, respectively, of 1850 and 1860, with the countries from which importations were made:

	1850.		1860.	
United States.......	493,153,112	pounds.	1,115,890,608	pounds.
Brazil..............	30,299,982	"	17,286,864	"
Mediterranean	18,931,414	"	44,036,608	"
British East Indies ..	118,872,742	"	204,141,168	"
British West Indies..	228,913	"	1,050,784	"
Other countries	2,090,698	"	8,532,720	"
	663,576,861	"	1,390,938,752	

FLAX AND FLAX-COTTON.

THE *Linum usitatissimum* of botany, from which the English *lint* and *linen* are derived, is now, by the peculiar circumstances of the production and consumption of textiles, and the comparative success of mechanical invention in the direction of flax manufacture, brought very prominently to public view. Many fibrous plants are used for cordage, clothing, and other purposes; among them hemp, jute, various tropical plants, &c. The New Zealand flax, or *Phormium tenax,* is much stronger than *Linum,* and very valuable for canvas and cordage, but the latter has almost a monopoly of manufactures of its class, and is common in all civilized countries and to all ages, from the Jewish era of "purple and fine linen" to the present day.

The Commissioner of Agriculture has received, recently, from different parts of the country, specimens of fibrous plants, indigenous, and seemingly worthy of experiment. The fibre of one of them, a member of the *Asclepia* family, is very long, fine, abundant, and exceedingly strong.

It is not improbable that new textiles may yet be added to the present list,

and found more productive, more easily worked, or better adapted to particular uses than any others now known. The specimen of *Asclepia* in question has been submitted to experiments, similar to those by which flax is cottonized, and the result is a beautiful article, stronger than cotton or flax-cotton, fine and lustrous, and apparently susceptible of working upon cotton machinery. It is cottonized at less expense than flax.

THE DEMANDS OF CONSUMPTION.

The diffusion of intelligence, the extension of civilization, and the general accumulation of wealth, are active causes for increased demand for clothing. The manufacture of cotton was nearly doubled between 1850 and 1860. It has now greatly declined, and flax will be required to help fill the hiatus and to supply the constantly augmenting demand. England has for several years averaged the consumption of about one hundred thousand tons of flax fibre, from a fourth to a third of which is produced in Ireland; nearly two-thirds is imported, Russia furnishing seventy per cent. of the importation, Prussia ten per cent., and Holland, Belgium, France, Egypt, &c., the remainder.

Our own production of flax fibre has been for several years decreasing. It was nearly eight millions of pounds in 1849, and less than half as much in 1859. At the former period Virginia and Kentucky produced more than three millions, nearly half the crop. In these years a decrease is noted in every State in the Union except New York, which gave an increase of sixty per cent., and (to be literally correct) South Carolina, which advanced from 333 to 344 pounds. The principal increase in the seed crop was in Ohio and Indiana, which now produce about two-thirds of the seed in the United States—405,927 bushels of the 611,927 secured. It may seem remarkable, in view of this fact, that not a pound of flax is reported in Ohio, a State which grows nearly half of the entire seed crop of the country. In Indiana the decrease in flax in ten years was from 160,063 to 32,636 pounds.

While production was diminishing, competition was increasing. Our imports twenty years ago were annually about one-third of the recent yearly importations, those of 1860 and 1861 being as follows:

	1860.	1861.
Hosiery, &c	$35,526	$14,944
Linens	9,245,816	6,851,230
Not specified	1,454,993	956,491
Tow	458	4,961
	10,736,793	
Under tariff of 1861		166,399
Unmanufactured flax	213,687	171,905
Total	10,950,480	8,165,930

The imports of flaxseed are small—in 1860, 513 bushels; in 1861, 104 bushels. The exports of 1860 were 2,715 bushels of seed and 37,809 gallons of oil; of 1861, 28,540 bushels of seed and 42,638 gallons of oil. The average prices of these exports were, in 1860, $1 40 per bushel for seed and 78 cents per gallon for oil; in 1861, $1 73 for seed, and 65 cents for oil.

SOIL.

The best barley land, in the flax districts of New York, is held to be the best flax soil. In the west, new prairie and old turf lands are frequently recommended. Recent timber clearings are desirable if suitably drained, or any good corn land, or rich, silicious soil in good tilth. Flax will grow well in any moist, deep, strong loam, upon upland. A light, sandy, soil should be avoided, as well as very low lands or river bottoms, upon which flax is very liable to mildew. Flax should be put in after some hoed crop, to be free from weeds. A weedy soil, in any location, should not be thought of in connexion with this crop.

SOWING.

To prepare for sowing, deep ploughing and thorough harrowing are requisite, when the land is sufficiently dry, without regard to light frosts, which will do little injury. Many use a Michigan double plough, and pulverize with a cultivator, running it both ways; it is advantageous in inverting the surface and stirring the subsoil.

The best manures are phosphates, plaster, ashes, and salt. Three or four bushels of a mixture of equal quantities of the three latter have been used as a special flax manure. Dr. Ure says that 30 pounds potash, 28 of common salt, 34 of burnt gypsum, 54 of bone dust, and 56 of sulphate of magnesia, will replace the constituents of an average acre of flax.

Sow none but clean, bright seed. In the west, where flax is grown for seed alone, little more than half a bushel per acre is planted. The seed is generally contracted for by proprietors of oil mills, who furnish seed again free to planters, generally with stipulations restricting the amount to be sown per acre. This causes the plants to grow stocky, and branch out near the ground, making the fibre coarse and variable, weak and brittle, and worthless for the manufacture of any but the very coarsest fabrics. Being grown for the seed alone, the object of the oil-makers is to get the largest amount for a given quantity distributed, which they obtain by this course, while the farmer, who burns or throws out the remainder of the plant to decay, has no interest in preventing this deterioration of the fibre.

This explanation is simple justice to western cultivators, whose knowledge of the culture seems impugned in the transactions of the Rhode Island Society for the Encouragement of Domestic Industry, in which, after a comparison of western and Canadian flax, it is said "that any failure to work western flax will be traceable to a want of knowledge on the part of the producer of the best modes of sowing, reaping, and curing it." In the west, flax is grown for its seed; in Canada, for fibre mainly, together with seed; and to these facts, the result of a definite purpose, and not to any lack of knowledge on the part either of Canadian or western farmers, the difference in the plant is due. If flax-growers in Ohio or Indiana should now desire to turn their attention to lint as well as seed, they will, of course, seek a change of seed, instead of using that which has attained, by repeated thin sowing, a fixed character for stocky, branching growth.

In growing flax for the seed and lint, from one bushel to a bushel and a half is the average sown in New York and other States producing lint. Two bushels will give finer fibre. In Belgium and in Russia, where the finest linens are produced, from two to four bushels are put in. Rich soils require less than poor ones. Thick sowing diminishes the branches; the fewer and higher upon the stalk the branches are the finer the fibre. The sowing should be as even as possible, and the ground levelled with a roller if it is designed to cut with a reaper. In prairie soils some prefer to cover with a roller. Heavy crops

are reported grown from seed washed into the soil by the rain. The usual mode of covering has been with brush or a light harrow.

The Belgians, who cultivate with great skill and weed very carefully, obtain a double crop by sowing white carrots, which grow finely after the flax is removed. The crop itself is a double product, yielding adequate returns for cultivation in its seed, and duplicating them in its fibre.

HARVESTING.

When the lower leaves begin to fall, and the seed hardens and turns brown, and the stalks assume a yellowish tinge, is the time to harvest. It has usually been pulled, but if grown very extensively in this country it must be cut with the reaper, to which course there are two objections: the loss of fibre and injury to its working qualities, and the gathering of weeds with the flax. Use the roller in preparing the ground, allow no weeds, and cut low in harvesting, and these objections will disappear. It should be carefully cut, partially dried, removed in straight gavels, bound in small bundles, and stacked as soon as practicable, to prevent injury from rains and insects, and then housed early. If harvest-rotted, or left to cure in the swath, the fibre is inferior in color and deficient in strength and fineness. For flax-cotton it may be cut with a mower.

The seed is removed by various processes—by tramping the straw with horses moving in a circle; by the use of the cylinder of a threshing-machine; by drawing through a hatchel; by rollers operating by horse-power; by threshing with flails, or by whipping over a smooth stone or board.

ROTTING.

There are two modes. Water-rotting is essential for the finest fibre. The process consists in fermentation, by soaking in water till the gluten is dissolved that holds together the fibres, and till the woody core or "boon" is decomposed, so that the brake or hatchel can detach it in fragments called "shives," leaving the lint ready for manufacture. Soft, river water is best. The time depends upon the ripeness of the plant, and perhaps other circumstances; sometimes five days, sometimes ten, and occasionally even twenty and thirty. It should be watched, and taken from the water as soon as the lint will separate from the woody part, and the harl or cuticle will peel easily from the lint.

Dew-rotting is generally practiced in this country. About the 1st of October spread a ton of straw evenly upon an acre of moist meadow, the bundles a foot apart, in straight rows; turning carefully by inserting a pole under the straw, and opening with a fork if it rots unevenly. The time varies with the condition of the straw and the state of the weather; with good weather, from one to two weeks will suffice; in dry weather it takes much longer.

YIELD.

Twenty bushels of seed and three tons of straw have been obtained by heavy seeding. Six hundred pounds of fibre and sixteen bushels of seed are regarded as large crops. In the west from eight to twenty bushels of seed are obtained. A correspondent gives nearly five hundred pounds of lint as the average, per acre, produced by one farmer in Rensselaer county, New York; while the general average of the county for thirty years is stated, by Mr. William Newcomb, not to exceed two hundred and fifty pounds.

At its present price—twenty-five cents per pound when reduced to lint, and three to five dollars per bushel for seed—it is an exceedingly profitable crop. At ordinary prices, when grown by farmers skilled in culture and preparation for manufacture, it "pays" far better than wheat and oats. It is claimed in the west that the seed alone furnishes a better average profit than wheat.

FACTS FROM CORRESPONDENCE.

Mr. William McMillan, a purchaser of flax fibre, residing in Cambridge, Washington county, New York—a locality in which the flax crop is very prominent—writes that flax-growers in his vicinity sow a bushel per acre; when ripe, pull and set in shock till dry; that the seed is taken off by machinery made for the purpose, and that it is then dew-rotted and sold at $20 to $30 per ton usually, but at twice as much the present year. The mill for dressing consists of a machine for breaking, and dressing boards and knives for taking out the shives. In the condition in which it is then found, it is purchased for the manufacture of twines, crash, shoe thread, and burlap. It is held that this crop is worth, at former average prices, from $10 to $15 per acre more than ordinary farm products.

Mr. Harvey Wilcox, of Greenwich, Washington county, New York, informs this department that in his vicinity flax is pulled by hand; that machines for pulling have been used, but are generally discarded, because they pull weeds with the flax; when dry, the seed is whipped off by hand, or with rollers on two horizontal shafts, driven by horse-power; three sets of knives and shaft cost about $100; two kinds of brakes are in use—the old style costing $75, and that of Sanford & Mallory costing $355, the latter effecting a saving over the other of fifteen to thirty per cent. of lint. After breaking, the dressing is done by an apparatus consisting of knives, which are round or blunt on the edge, set in a circle or on a horizontal shaft, and revolving close to an upright board in which is a notch cut to feed in the flax. It is the usual custom of millers to buy flax in the field after it is pulled. Some rot, dress, and sell it by the hundred. Troy and Cambridge are their markets, and agents of Massachusetts mills are also buyers. It now produces from $60 to $100 per acre for the crop. Oats yield $15 to $20.

The following extract from the flax correspondence of the department is from a letter of Mr. Ingalsbe, corresponding secretary of the Washington County (New York) Agricultural Society, in answer to a circular relative to flax and flax mills in his county, which, with the neighboring county of Rensselaer, is largely interested in this business:

"Are the mills worked by water or horse-power?"

"With us they are worked by water. There would be no difficulty in running them by horse-power, as no great amount of force is required to work them."

"What is their cost?"

"This depends somewhat upon the size and quality of the buildings to be erected. A plain and commodious barn-like building is all that is necessary. After the building is complete, and a dam for furnishing the water-power is built, I think the cost of putting in machinery sufficient for a single shaft, with four sets of blades or knives, including, also, the water-wheel complete for running, would not exceed two hundred and fifty dollars; but several shafts may be erected, with a trifling additional outlay, for each in the same building. When business will warrant it, this is more economical than to erect other buildings and fixtures. In the above estimate should be understood as including the old-fashioned brake, in contradistinction to a new invention manufactured in New York city, at $355. It nearly cleans the fibre of shives by the single process of breaking, and, though the flax must afterwards be submitted to the process of swingling, there is a sufficient saving in lint to pay for the new machine in a short time."

"Is the flax merely 'broken' by them, or is it merely 'dressed,' *i. e.*, freed from the 'shives?'"

"It is both broken and freed from the shives."

"Do the owners of mills purchase the flax, or do they work it on shares for a stipulated price?"

"They both purchase the flax and work it for a stipulated price, as they can best agree with the grower of the crop. I do not know of any working the crop on shares. The owners of mills usually prefer to purchase the crop in the field, after it is harvested or pulled, at so much per acre; and previous to this year the average price per acre has ranged from thirty to thirty-five dollars. If the owners of the crop choose to get off the seed and rot the straw themselves, the mill-owners will then purchase the rotted straw at a price, per ton, heretofore

twenty-five to thirty dollars; or they will dress the flax for two dollars and fifty cents per hundred weight, and also sell the lint without charging commission, if the owner prefers. Aside from the chance of making larger profits, the mill-owner prefers to purchase the crop in the field and rot it himself, presuming, with good reason, that in the latter case the straw will reach his mill in better average condition than if the rotting process is subject to the carelessness or caprice of a number of individuals, many of whom have but limited experience in the business. The flax is, with us, always dew-rotted."

"What is the profit of growing flax in comparison with other crops?"

"The cost of growing, harvesting, and rotting an acre of flax, at the ordinary price of seed, (say, $3 50 per bushel, the present price,) should not exceed twelve dollars per acre, exclusive of interest on the cost of land.

"Now, one ton of rotted straw, with two bushels of seed, is a low acreable average; and such an acre now readily sells at $60 for the straw, and $35 ($3 50 per bushel) for the seed, or $95 for the whole. Although these are double the ordinary prices, a much lower rate would leave a fair margin for profit, as compared with any of our staple crops; but as the times are, the price is steadily advancing.

"There are some drawbacks to a very extensive cultivation of this crop, as, for instance, the great amount of manual labor that would be required to harvest it, for the want of a suitable machine to pull the flax, and also the general belief that it is a very exhausting crop. There is no doubt that any farmer may, with good management, cultivate a few acres with a promise of a fair remuneration."

"Where is the market?"

"Boston, I think, mainly. The increased demand for textile materials will open other markets. Even now the refuse or poorer qualities of tow, (no inconsiderable item,) find a ready sale at the paper manufactories."

AS A DOMESTIC MANUFACTURE.

In the good old days not, indeed, of primitive fig leaves, but of linen aprons fabricated by the fair hands that joined in loving embrace the hard palms of our revolutionary fathers, domestic industry sought to promote alike the comfort of the family and the wealth of the State, giving thus to the children a bright example of two eminent virtues of a free people—industry and loyalty.

The spinning wheel was then to be found in every house; its sweet music was for *ennui* a preventive better than a cure, and for restive infancy a lullaby only less effective than the human voice. Health waited on the gentle exercise with its roses, and thrift from its cornucopia strewed with plenty the pathway of industry.

Garments like gossamer for blooming beauty, and breeches of tow for burly toilers; dresses for the night and clothing for the day; all covering of the person, from the skilfully wrought socks, for the protection of the "sole of the foot," to the netted nightcap for the "crown of the head;" serviceable diaper and delicate handkerchiefs; clothing for the cradle and habiliments of the grave; all were products, to a greater or less extent, of flax and of home manufacture.

But change came. The spinning wheel was set aside; its hum became a fading echo of the past. Wealth increased; silks and satins figured in importations, and domestic linens were discarded.

A potent influence in this change was the advent of cotton, with the gin of Whitney, and the jenny of Arkwright. Indeed, this pressure of cotton competition may be said to have killed the flax manufacture; but the force of this pressure is at present relieved, and skill and invention are fast removing the obstacles to the production of flax as a successful competitor of cotton in its season of greatest abundance and cheapness.

It is not to be expected that domestic spinning and weaving of linen will again prevail, nor is it to be desired, if improved machinery can accomplish results never before fully attained, with a celerity unapproachable in simple home industries, though a mine of wealth may yet be found, for the homes of the great masses living by their labor, in some of the various processes of the flax manufacture.

USES OF FLAX.

For many of the purposes of manufacturing, flax is superior to cotton; it is stronger and more durable. In fabrics made of wool, in part, the fibres receive the dye better and mix more uniformly. It is better than cotton for summer cloths, table linens, duck, drillings, bags, and many other goods; it is superior for cordage and all sorts of twine. The seed is a paying crop, even if the fibre is not saved; besides the oil, the oil-cake is in great demand for fattening stock, and is worth almost its cost for manure alone. Large quantities of tow are now used for paper manufacturing in the present dearth of paper stock.

EARLY EFFORTS IN ITS MANUFACTURE.

The growing of flax commenced in New England with its first settlement. As early as 1640 the Massachusetts Assembly issued an order inquiring "what men and women are skilful in the breaking, spinning, weaving, what means for the providing of wheels," and also "what course may be taken for teaching the boys and girls the spinning of yarn."

In the "New Netherlands" the Dutch women, who had long excelled in this manufacture, manifested a just pride in their display of "ample stores of strong, smooth, and nicely bleached home-made linen, and stockings of blue, red, and green worsted."

In 1719 an immigration of Scotch Irish from Londonderry, Ireland, settling in a township which they named Londonderry, and in other towns in New Hampshire, greatly improved the current colonial knowledge and skill in flax culture and manufacture.

Pennsylvania, Maryland, Virginia, and other States, encouraged the growth of flax and manufacture of linen by legislative enactment and by personal effort, until the big wheel and the little wheel were almost as common a household treasure as in New York and New England.

In 1752 Dr. Franklin stated, before the British House of Commons, that ten thousand hogsheads of flaxseed had that year been exported from Philadelphia. In those days the Pennsylvania farmers were supposed to make nine-tenths of all their wearing apparel from the hemp, flax, and wool of their farms.

IMPROVED PROCESSES AND MACHINERY.

The great obstacle to the enormously extended production of flax is the expense of its preparation for spinning. This difficulty, now sought to be obviated both for the production of lint and of flax-cotton, is twofold—the want of a cheap and perfect solvent of the cement which binds in a mass the ultimate fibre, and of a machine to separate perfectly, at one operation, the fibre from the woody core.

The old process of breaking, scutching, and hatchelling, by the rude machines of our fathers, is too well known to require description. The old brake has been superseded by numerous improvements, consisting generally of an adaptation of fluted rollers, which so break the woody core or "boon" as to make an easy separation of the broken fragments or "shives," leaving the tough fibre finely subdivided, and ready for the regular linen manufacture.

Hatchelling, as of late done by machinery, has been thus described:

"The flax, being cut in lengths of ten or twelve inches, is arranged in flat layers called stricks, the fibres parallel and ending together. Each of these is held by two strips of wood clamped together across its middle, or sometimes across one end. They are placed around a revolving drum, within which another drum, armed with teeth, rapidly revolves in a contrary direction, and combs the flax as the ends fall among the teeth. Much ingenuity is displayed in the modifications of this machinery, and also of a preparatory machine for dividing the fibres into equal lengths and sorting the lower ends, the middles, and the upper ends, each by themselves. The stricks, when hatchelled, are assorted according to the fineness

of the fibres, those made of the lower ends being the coarsest; the divisions, however, being much more minute than those of each fibre into three lengths. The next operation, preparatory to spinning, is to lay the fibres upon a feeding-cloth, each successive wisp overtopping half way the one preceding it. The feeding-cloth conveys them to rollers, between which they are flattened and held back as a second pair, more rapidly revolving, seizes the part in advance and draws out the flax. These tapes, thus formed, are then joined together and slightly twisted."

An improvement known as Schenck's process, patented in 1846, has been regarded as a valuable expedient in the preparation of fibre, but it does not remove the whole difficulty. It consists merely in steeping the flax stems in warm water, heated artificially to the temperature best suited to fermentation, which is from 80° to 90°. The result of this bath, of 70 to 90 hours, is an increased percentage of fibre obtained, increased fineness, and enhanced spinning qualities.

The Dutch have long had a process in which the linen is boiled in a weak lye, and subsequently treated with sour buttermilk, to aid in removing alkali and earthy impurities.

The method of M. Claussen for making flax-cotton (which had been made by a process in some degree analogous many years ago) consists, first, in boiling the cut and crushed stems in a dilute solution of caustic soda. The fibre is then immersed in a bath of dilute sulphuric acid, and boiled an hour. Afterwards it remains an hour in a solution of carbonate of soda, followed by a half hour's bath in a weak solution of sulphuric acid. The effect of this combination of chemical agents is to explode the fibre, making a product resembling cotton.

Coming down to the present effort of our inventors and manufacturers to facilitate and cheapen prepared flax fibre, it is proper to say that important inventions are now in process of development. In the last year or two invention has accomplished much in certain directions. Sanford & Mallory, of New York, have taken the lead in brakes, patents having been issued in 1862 for "breaking and cleaving," "dressing," "scutching and cleaning," and "separating fibres from plants." One patent for dressing has been issued to G. F. Schaffer; one for "cleaning and dressing" to J. E. Crowell; one for the manufacture of flax-cotton to J. P. Comly, of Dayton, Ohio. A "hemp brake" has been patented to Thomas H. Murphy. In April of the present year, (1863,) Sanford & Mallory patented another machine for breaking flax and hemp. Patents have also been granted for "machinery for separating the fibres of tropical plants" to Edward Juanes y Patrullo, of New York. This is a machine for separating the fibres of the *Agave Americana*, by a process of tearing and scraping, at a high velocity, the leaves of that plant.

Before proceeding to a cursory examination of the present condition of our flax manufactures, let their paucity and comparative poverty be manifest from an exhibit of the amount of flax fibre on hand in 1860. The total home product in 1859 was but 3,783,079 pounds, equivalent to 94,576 bales of cotton; but there was an import from Great Britain amounting to 105,487 pounds. As our total import from Great Britain, Holland, and Russia was $213,687, the aggregate amount must have been nearly a million and a half of pounds. Thus the total manufacture may have been 5,000,000 pounds, or one and a third per cent. of the amount of our cotton manufactures.

Smith, Dove & Co., at Andover, Massachusetts, use 700 tons annually, mostly of Irish, Dutch, and Archangel flax, for shoe thread and sewing twines. For coarse yarns they use the American. They say: "Experience in the cultivation of the plant and its preparation for the market, and the improvements in the machinery for the manufacture of flax goods, may in process of time enable us to produce goods of fine quality from American flax. Heretofore, the chief obstacle to the growing of flax in the United States has been the high price of labor, which has prevented the farmers going into it to any extent,

except for the seed, the preparation of the lint for the market being the part in which the labor is most expensive."

Several other small establishments, producing flax cordage, are reported in the census schedules, in Massachusetts, giving a total product in 1859 of nearly $40,000, in addition to $213,900, the value of goods made by Smith, Dove, & Co.

Linen goods are manufactured to a very limited extent, mainly in Massachusetts, by the following companies: Fall River Linen Company, making use of 350 tons of flax and hemp, producing a product valued at $300,000; Hampden Flax and Hemp Mills, using 90,000 pounds flax, (300,000 pounds hemp and 120,000 pounds cotton,) producing (of flax simply) $18,000; A. H. Stevens, of Weston, 300 tons, $150,000.

The preparation of flax fibre for spinning on cotton machinery has long been an object of inquiry. Experiments in that direction were made in Europe long before Claussen's discoveries. Investigations made in Pennsylvania twenty years ago established the fact that flax may be cradled as well as pulled, and that it can be manufactured without rotting, thus saving time and labor, avoiding the liability of mildewing and staining the fibre, economizing the process of bleaching, and obtaining a stronger material than is produced by the old processes. These improvements were effected by a machine invented by Sands Olcott, in 1840. His investigations were successfully continued during 1841 and 1842, and public lectures were delivered in Philadelphia, eliciting a good degree of public inquiry and discussion, and showing the practicability of producing fibre ready for carding at eight cents per pound. The death of Olcott put a period to these operations, so successfully commenced; but the person who built his machinery, and was particularly conversant with his operations, is still living, and may assist essentially in the solution of the flax-cotton problem. It is believed that Olcott made further progress than recent experimenters have as yet reached, and that some of the most promising machines of recent introduction embody the principle, more fully developed, in his invention.

Flax-cotton is now produced, of a quality not yet equal to the requirements of a perfected art, but suited to certain valuable uses, in various places. Among the experimenters and manufacturers are the Rhode Island Society for the Promotion of Domestic Industry; the Flax-Cotton Company, at Lockport, New York; Mr. Fletcher, of Oswego, New York; Mr. Beach, of Penn Yan, New York; Stephen Randall, of Centreville, Rhode Island; S. Robert and Geo. C. Davies, of Cincinnati, Ohio; and O. S. Leavitt, of Louisville.

Hon. Charles Jackson, of Providence, Rhode Island, a gentleman of profound knowledge of American manufactures, whose efforts have been unremitting and influential in securing the aid of the government to proposed experiments in perfecting cottonized flax, says, in a letter to this department, that "the government will surely be disappointed in its receipts under the tax bill, unless the mills can continue production." Referring to the immense waste of flax straw in the west, he adopts the assertion "that more than a hundred thousand bales of flax, from one district in the west of a hundred miles square, could be furnished now, if the preparatory machinery could be put in operation."—(See article on Flax-Cotton.)

Hon. W. R. Staples, Secretary of the Rhode Island Society for the Encouragement of Domestic Industry, reports that in the prosecution of experiments it was found difficult to obtain a few pounds of straw, and even that "had been harvested more than twenty years ago." He alludes to a jealousy among the inventors, which obstructs united effort in the work of successful experiment, and to their disposition "to realize," when a product is obtained that will sell, either to be mixed with wool or spun into coarse fabrics. "One experimenter fails," he suggests, "in making his fibres of an equal length, one in clearing the

fibre of the shive, one in getting a sufficient fineness, and so all are discouraged; whereas it would seem to need little more than united effort to bring the product to perfection."

There is naturally a disposition on the part of some manufacturers to obtain a monopoly of the benefits derivable from improvements, while societies, the manufacturing interest generally, and the best interests of the country, demand governmental aid and free competition in discovery, with open enjoyment of its results.

Geo. C. Davies, of Cincinnati, Ohio, sends to this department specimens of "flax wool," or "erolin," made from the coarse flax straw of the west. It is a "fair" article, less fine than New York specimens, but valuable, when mixed with wool or cotton, as a cheap textile. It is made from tow, produced from straw at three cents per pound, at a good profit; two pounds of this tow producing one of flax-cotton, at a cost of one cent for labor, making a total cost of seven cents per pound. He is using about a ton of the raw material daily.

Stephen M. Allen, of Massachusetts, has in operation machines for the manufacture of a product which he calls "fibrilia," which can be spun and woven on cotton machinery. He claims to be able, with machinery in process of construction, to separate the fibre entirely by mechanical means alone. By his process "the flax or hemp straw is mown or cradled like grain, and is cured like hay, after which the seed is threshed out in the ordinary way. It is then passed through the brake, which takes 1,400 pounds of shives out of every 2,000 pounds of straw, and the fibre is then steeped in the retort with warm water at different temperatures, which dissolves the gluten in the fibre, after which it is rinsed or washed before coming up to the boiling point. It is then dried and run through the stranding machine, to be followed by carding, spinning, &c., on the short-stapled machinery. If it needs bleaching or coloring, it may be done in the retort at first before removing."

A committee of the Rhode Island Society for the Encouragement of Domestic Industry reported, in October, 1861, upon samples of flax-cotton submitted for premiums, that while none of the contributors were entitled to the reward offered, "the encouragements for ultimate success are too strong to allow the investigation to rest here." From the investigations since made, the manufacturers of Rhode Island are confident that such success will be attained, and a product obtained that will compare favorably in price with cotton in ordinary times.

Another committee of the same society, appointed to attend the meeting of the New York Agricultural Society, report the result of the examination, in connexion with representatives of the New York society, of the process of the Lockport Flax-Cotton Company, as follows:

PROCESS.

1. Breaking, by passing through revolving fluted rollers.
2. Dusting, by passing through a machine similar to the "willow" of the cotton manufacturers.
3. Scutching.
4. Combing, by a process like that for preparing worsted yarn.
5. Dusting again.
6. Steeping the fibre twenty-four hours in tepid water.
7. Boiling in soap and soda ash (three pounds of the latter per one hundred pounds of fibre) for eight to twelve hours.
8. Immersing in chlorine for two hours or more, as necessary for bleaching.
9. Immersing in sulphuric acid for two hours, (of one degree of strength.)
10. Dipping in a solution of alum, borax, and salt.
11. Washing in distilled water with a little sal soda.

12. Drying by heat from steam pipes.
13. The fibre is passed through a lapper.
14. Carded on machines similar to wool cards.
15. Passed through a railway head with rotary gills.
16. Passed through a drawing frame.

The loss in passing through the breaker is estimated at thirty per cent.; through the duster, thirty per cent. more; in scutching, five per cent. The entire loss, from straw to cottonized flax, seventy-five per cent.

The cost of straw is estimated at $10 per ton green; rotted, $12 to $15 per ton; cost of labor, three and a third cents per pound; cost of rotted flax, three cents; total cost, six and a third cents per pound.

Such are some of the indices of progress in the effort towards the substitution of flax for cotton, to be worked upon cotton machinery without material alteration. They mark what it is confidently hoped will prove a new era in the history of textile fabrics. The government has appropriated $20,000 to this Department, (through the persistent and intelligent efforts of Hon. H. B. Anthony, senator from Rhode Island,) to be used in continuing these investigations and perfecting the process already half successful. Should these efforts be crowned with success, Congress, the Department, the manufacturing interest, farmers, and the world at large will have cause for hearty congratulation, and reasonable excuse for the gratification of a proper pride.

TOBACCO CULTURE.

TOBACCO was unknown to Europeans until after the discovery of America. Some sailors having been sent ashore in Cuba by Columbus, were surprised to see the natives of the island puffing smoke from their mouths and nostrils. They afterward learned that this was the smoke of the dried leaves of tobacco. This plant was extensively cultivated by the natives on the islands and the continent. There are numerous varieties of it—some mild and fragrant; others extremely pungent and fetid; some with a narrow, and others with a broad leaf, which is used in the manufacture of cigars. It is a perennial plant, with a flowering stem. Its botanical name is *Nicotiana*, of which genus there are as many as thirty species, only two of which—*Nicotiana Tobacum* and *Nicotiana Rustica*—are much cultivated for use. The specific name, *Tobacum*, is not, as has been supposed, a corruption of *Tobago* or *Tobasco*, whence it was brought, but, as Humboldt has shown, is the Haytian word for the pipe in which it is smoked. It was first introduced into Spain, in 1560, by Jean Nicot, from whom it derives its generic name. The practice of smoking it was introduced into England, in 1586, by Sir Walter Raleigh.

Tobacco acts as a sedative, calming the nervous system and inviting to repose; but when used to excess, it produces nausea, debility, and sometimes death. Its active principle, which is procured either by distilling or burning its leaves, is a deadly poison. Its medicinal properties are very doubtful. The opinions of medical authors on this point are diametrically opposite. There can be no doubt, however, that the excessive use of it often shortens human life.

The cultivation of tobacco has greatly increased in the United States during the last decade. In 1850 the quantity raised, as stated in the census report,

was 199,752,655 pounds; in 1860 the quantity was 429,390,771 pounds. Some idea of the extent to which its production and manufacture enter into the industrial resources of the country may be formed from the fact that the value of tobacco in the leaf, exported in 1860, was $15,906,547; to which add manufactured tobacco exported, $3,372,964; total exports in 1860, $19,279,511.

Tobacco is grown in all the States of the Union. Those, however, which are the chief producers are Virginia, Kentucky, Tennessee, Maryland, North Carolina, Ohio, and Missouri. The following statement shows the quantity produced in the above-named States in 1850 and 1860:

	1850.		1860.	
Virginia	56, 803, 227	pounds.	123, 967, 757	pounds.
Kentucky	55, 501, 196	"	108, 102, 433	"
Tennessee	20, 148, 932	"	38, 931, 277	"
Maryland	21, 407, 497	"	38, 410, 965	"
North Carolina	11, 984, 786	"	32, 853, 250	"
Ohio	10, 454, 449	"	25, 528, 972	"
Missouri	17, 113, 784	"	25, 086, 196	"

The peculiar condition of the country at the present time—the fact that some of the tobacco-growing States are disloyal, while others are the battle-field of contending armies, where the industry of the country is diverted from its wonted channels—turns the attention of farmers to the culture of this plant. We propose, therefore, to give a concise statement of the method usually pursued in cultivating and preparing it for market.

Although tobacco is grown through a wide range of temperature—from the equator to Moscow, in Russia, in latitude 56°, and through all the intervening range of climate—yet, as it requires a considerable length of summer to bring it to perfection, it does not ripen well in high latitudes. It is, therefore, necessary to sow the seed in a hotbed, or in some sheltered place, as early as the spring will permit. If on new soil, the bed should be prepared by burning brush upon it; if on old soil, by the admixture of well-prepared compost in addition. The seed-beds should be long and narrow, in order that they may be easily kept free from weeds. The soil is to be thoroughly pulverized. The seed should be mixed with dry plaster or ashes, and sowed broadcast. A table-spoonful of seed is sufficient for a square rod. It should not be covered, but the bed should be rolled or pressed with a board or with the hoe, and should be kept moist. The utmost care should be observed to prevent the growth of weeds among the young plants, whose growth must be urged forward as rapidly as possible. They should stand in the seed-bed from half an inch to an inch apart. Great care must be taken to guard them from the late frosts of spring. They are liable to be attacked, in an early stage of their growth, by a small black fly, which injures, if it does not destroy, them. On this account, their growth should be stimulated by the application of ashes, soot, plaster, or guano, and they will soon get beyond its ravages. They should also be watered in dry weather from a common sprinkler. In about two months they will have attained a height of three inches, and be large enough to be transplanted.

A sandy loam is the best soil for growing tobacco. It should be thoroughly manured the fall previous by at least thirty loads of good stable or barnyard manure, and ploughed; should have a southern exposure, and should be ploughed and harrowed, and thoroughly pulverized in the spring. About the 1st of June the plants should be set in rows three and a half feet apart, and in these rows three feet from each other. To facilitate the use of the horse-hoe or cultivator, the land should be marked crosswise, and the plants set at the intersection of the marks. Before setting, form a slight hill with the hoe, leaving a hollow on the top, and, unless the transplanting be done in wet weather, water should be

put in each hill. Make a hole of a suitable depth, and, having carefully placed the root of the plant in it, press the earth firmly around it. As some plants will fail to grow, care must be taken to have enough remaining in the seed-bed to supply failures.

In one week after transplanting pass through the rows with the cultivator and hoe the plants, and repeat the hoeing several times during the season. No weeds must be allowed on the field. The plants must be constantly watched, to protect them from the ravages of the tobacco worm. This worm, which preys upon the tobacco in the months of July and August, is the larva of the Sphinx Carolina. The moth is of a gray color, has on each side of the abdomen five orange-colored spots encircled with black, and has a tongue that can be unrolled to the length of five or six inches. The larva is a long, green worm of a disgusting appearance, having a caudal horn, and is generally known as the tobacco worm, though it is sometimes called the horn worm. The utmost vigilance is necessary, to prevent this worm from injuring the plants. They must be examined morning and evening, and the worms and the eggs deposited by the fly must be picked off and destroyed. The eggs will be found on the under side of the leaf. Turkeys will devour the worms greedily, and kill them even after their appetite is satiated. The chief reliance, however, must be upon seizing them with the thumb and finger and destroying them.

In order to throw the energies of the plant into a few large leaves, it is necessary to cut off the top at the time of flowering—cutting off not only the flower, but a few of the top leaves which cannot be fully developed. The number of leaves to be cut off with the top depends upon the forwardness and strength of the plant, some requiring the removal of more and some less. The suckers at the foot of each leaf stalk must be carefully removed in the incipient stages of their growth. So important was this *suckering*, as it is termed, regarded in Virginia, and so surely do the suckers injure the quality of the tobacco, that penal laws were at one period enacted to prevent negligence in destroying them.

Much discernment and good judgment are necessary to determine when the crop is sufficiently mature for the harvesting. When ripe it turns spotted, and the color of the lower leaves changes to a brown. It is essential that the plants be housed before the first frost. The whole crop will not be ripe at the same time, and it will be necessary to pass through the field, selecting such plants only as appear to be ripe. They are cut with a knife similar to that used for cutting cornstalks, and are laid upon the ground for a few hours to wilt, but must not be long exposed to a hot sun. They are then removed to the tobacco house, and hung up by pegs driven into the stalk by a mallet about four inches from the largest end of the stalk, or by tying the stalk to poles which are laid on beams or joists as near to each other as possible, and still permit a free circulation of air. If hung too closely, they are injured while in a green state. By some planters the drying is hastened by a gentle fire underneath, but generally reliance is placed on the air, which is freely admitted in dry weather, but is excluded in damp.

Many planters think it best to commence the harvest when the majority of the plants are ripe, and then take them clean in the cutting. They think the scattering plants are more liable to injury from wind and rain. Good planters, doubtless, differ on many points in the culture of tobacco; and those who engage in the business must profit from their own observation and experience.

The size of the tobacco shed should vary with the extent of the crop which it is proposed to cultivate. Its height may be such as to receive several tiers of plants when suspended on the poles. These poles should be placed five feet apart. A free ventilation should be secured from the sides of the building by having the boards placed vertically, and every third board hung on hinges. The building should also admit air from beneath. It should have a tight roof,

on which there should be a ventilator constructed with slats in the form of Venetian blinds. The main principle to be secured is a free and perfect ventilation, which shall carry off the moisture of the plants as fast as possible. During the prevalence of cold, drying winds, the ventilators on the windward side should be closed, and in very damp weather they should all be closed. A building 35 feet long, 24 feet wide, and 15 feet high, will receive three tiers of plants, and will store the tobacco grown on an acre.

When the plant is fully cured, which may be known by the stem of the leaf becoming free from sap, it is to be stripped from the stalks. A damp day should be selected, so that the leaves may not crack and waste. It is essential that they be pliant. As it is stripped from the stalk it is assorted into different qualities, according to the uses to which it is to be applied in manufacturing. The broad leaf, which is suited to form wrappers for cigars, must be carefully laid by itself. A sufficient number of leaves is tied together to form what is termed a *hand*, and the leaves are bent over, forming a head, around which a wrapper is wound and tied. These are laid in piles, the bent ends outward, and, after remaining for a few days, they will be ready to pack. In Virginia and Maryland tobacco is packed in hogsheads; in Connecticut, in boxes. Heavy pressure is used by which the tobacco is pressed into a hard mass, so that a hogshead contains from 750 to 900 pounds. In this condition it is sent to market.

We recapitulate several points on which experienced growers strongly insist, because they express conditions of success in cultivating tobacco.

1. The land must be in good condition—well enriched with manure. It must be ploughed in the fall, and again in the spring, and be thoroughly pulverized.

2. The plants in the seed-bed must be carefully weeded and guarded against the fly, and so thinned out as to require a hardy growth before being transplanted.

3. During the season for the ravages of the worm the plants must be examined twice each day for the purpose of destroying them.

4. In curing, the leaf-stalk must become perfectly freed from moisture.

5. We add: farmers who are commencing the culture of tobacco should avail themselves of the services of an experienced man who can supply that knowledge which cannot be learned from books.

It may be proper to say a word in regard to the profit of the crop. In the first place, if the crop is grown on one field but for a single season, it leaves the land in good condition for any crop the next year. It is highly manured and free from weeds.

It may be followed by wheat, and then by grass, and by this rotation remunerative crops may be secured without exhausting the soil. The worn-out fields in some of the tobacco-growing States should be monitory to cultivators, and teach them one of the most important lessons of modern tillage, viz: the necessity of a proper rotation of crops.

Next, a crop of tobacco successfully grown and cured commands a ready sale at from twelve to fifteen cents per pound. At this present writing, owing to the peculiar circumstances of the country, the price is enhanced. If unfortunate in the curing, the owner will not realize more than half the current price. The following statement shows the net profit of raising tobacco on alluvial soil in Whately, Mass., and the value of succeeding crops, by observing a proper rotation. It is an extract from a letter to the Country Gentleman, February 28, 1861. The crop described was grown by Elihu Belden, on a field of twelve acres, which was thoroughly prepared, hoed three times, and the suckers and worms carefully removed from the plants. The product was 23,850 pounds of tobacco, or nearly one ton to the acre.

Expenses.

Interest on land, at $100 an acre	$72 00
180 loads of manure, at $1 50	270 00
8,400 pounds of guano, at 3 cents	252 00
2,400 pounds of superphosphate, at 2½ cents	60 00
Entire labor, on twelve acres, of preparing land, setting, cultivating, and harvesting	660 00
	1,314 00

Returns.

20,250 pounds prime leaf, at 12½ cents	$2,531 25
3,600 pounds "fillers," at 4 cents	144 00
	2,675 25
Cost	1,314 00
Net profit	1,361 25

After harvesting the tobacco, he ploughed the land nine inches deep, and sowed it, September 18, 1859, with 18 bushels of Kentucky white bald wheat. This, when harvested, yielded 540 bushels of wheat and 36 tons of straw.

Expenses.

18 bushels seed wheat	$32 40
Labor of ploughing, sowing, and harvesting	74 00
	106 40

Returns.

540 bushels of wheat, at $1 62	$874 80
36 tons of straw, at $5	180 00
	1,054 80
Cost	106 40
Net profit	948 40
To which add the profit on tobacco the previous year	1,361 25
Net profit for two years	2,309 65

The land, then stocked with timothy, would, for three years, bear enormous crops of hay on the strength of the unexpended manure.

A survey of the agriculture of Onondaga county, New York, in 1859, shows tobacco culture to be profitable and popular in that locality, yielding an aggregate of $150,000. The variety is the Connecticut seed leaf, introduced there a dozen years previously. In 1855 the average product throughout the country, by an accurate census, was 1,178 pounds to the acre. The usual estimate is now 2,000 pounds. The following estimate for an acre is made at ordinary prices:

Expenses.

Plants	$2 50
Manure, ten cords	20 00
Fitting ground and marking	4 50
Planting and setting	5 00
Cultivating and first hoeing	2 00
Cultivating and second hoeing	1 50
Topping and killing worms	1 00
Suckering first and second times	2 00
Suckering third time	4 00
Harvesting and hanging	6 00
Stripping one ton	10 00
Five packing boxes	5 00
Labor of packing	1 50
Twine for hanging	1 00
	66 00

Returns.

2,000 pounds, at 13½ cents		$270 00
Deduct—For shrinkage	$27 00	
For transportation and commissions	25 00	
		52 00
		218 00
Cost		66 00
Net profit		152 00

In Iowa and Illinois the yield is given by correspondents at from 1,000 to 1,600 pounds per acre.

Mr. M. Soverhill, of Wisconsin, gives the following account of cost and income from ten acres grown in 1862:

Expenses.

Rent of land, at $10 per acre	$100 00
Ploughing and preparing land	28 50
Making and sowing plant beds	3 55
Fencing beds	1 50
Weeding beds	12 00
Watering beds	5 00
Setting beds	27 50
Cultivating and first hoeing	14 00
Cultivating and second hoeing	17 25
Three days' worming	3 75
Seven days' topping	8 75
Thirty days' suckering	37 50
Seventy-two days' harvesting	90 00
Team work, harvesting	10 00
Stripping and casing	75 00
Interest on cost of shed and fixtures	35 00
	469 25

Returns.

Plants sold	$26 00
Seeds sold and for sale	25 00
Eight and one-half tons of tobacco, at 10 cents per pound	1,500 00
	1,651 00
Cost	469 25
Net profit	1,181 75

Instances are noticed, in the history of this culture in Connecticut, of the production of 2,500 pounds per acre, realizing about $400, not merely for a single acre, but including returns of entire fields of many acres in extent.

Such results are due not to the superior fertility of the soil over that of Virginia, but to the large amount of fertilizing material employed.

It has been a question with some whether this high culture is more profitable than the usual four-shift system of Maryland and Virginia, with clover as its means of fertilization. Yet it can hardly be considered a question by intelligent tobacco-growers of the present day. Indeed, within a few years, fertilizers have been greatly depended on in those States. Oliver N. Bryan, of Maryland, in his prize essay on tobacco, recommended: "First, Peruvian guano; second, hog manure; third, well-rotted oak ashes; fourth, well-rotted stable manure, with plaster. If guano is used, it should be put on at the rate of one thousand pounds to the acre." W. W. Bowie, of Maryland, in his prize essay, advocated a liberal top-dressing, every ten days, of a compost of unleached ashes, "virgin woods earth," pulverized sulphur, plaster, and salt. He would apply guano on light soils, but not on rich land.

Cultivators in the States of Maryland, Kentucky, and Ohio, report as an average, under the system of cultivation practiced, and without much manuring in the latter States, from 1,000 to 2,000 pounds, according to quality of soil and variety of tobacco.

A writer upon the culture in Virginia has stigmatized it as the bane of Virginian agriculture. That the deterioration of the soil of the Old Dominion is the result of hard cropping, shallow ploughing, and no manuring, rather than of the culture of tobacco, is very evident from the significant fact that the tobacco lands of Connecticut, under high culture, are constantly improving, while crops are diminishing wherever the system of Virginia is practiced.

IMPHEE AND SORGHUM CULTURE, AND SUGAR AND SIRUP MAKING.

BY J. H. SMITH, QUINCY, ILLINOIS.

The condition of our country during the last two years has been such as to awaken the public mind to new and persevering investigations for the purpose of ascertaining whether the soil and climate of some of our northern States may not be capable of producing many of those articles which we have heretofore been accustomed to obtain from a more southern latitude; or at least such others, of similar nature, as would sufficiently supply their places.

Among these agricultural productions to which attention has recently been more particularly directed are the Chinese and different kinds of African or Imphee sugar-canes. As they promise to supply us with such necessaries as sugar and sirups, and at a time when our supplies of the latter seemed about to fail, they are not very likely, especially under present circumstances, to fail of receiving a fair trial and full investigation of their real merits. No plants ever made their appearance at a more favorable period for having their excellencies sought out and appreciated. Already have they succeeded in winning their way sweetly into the confidence of the farming community. Already have they proved themselves capable of yielding to the labor expended in their production a recompense more than fourfold.

The great problem of their fate is, perhaps, yet to be solved; and still, if we should judge from the progress already made, we can hardly doubt that their products, in a few years more, will become one of the great staples of our soil, and compete with pork and flour as articles of commerce and trade. Still less reason is there for doubt when we compare this progress with the long struggle which the planters of the south experienced before they became masters of the culture of the sugar-cane, and the manufacture from it of sirup and sugar. Upon such comparison we may well exult with pride and confidence at the advance which we have already made, though yet feeling much in the dark as to the merit which these plants actually possess, and looking earnestly forward for the results of experiments yet to be made.

The government, in its late policy concerning the agricultural interests of the country, deserves much praise for its efforts to introduce to the American farmer new seeds and plants, promising a world of wealth to the nation. The Agricultural Department, with facilities for scientific investigation, will doubtless impart freely and promptly such instruction concerning the soil and nutriment which the plants need in order that they may yield to their utmost capacity, and thereby prevent, in a great measure, the evil consequences which might ensue upon an improper and hap-hazard cultivation. Equal zeal in the same cause is certainly the duty of the farmers themselves. With a view to contribute to the general fund such information as several years of actual experience with these plants has afforded to one individual, these lines have been written and are submitted to the public.

Of the cane plants hitherto cultivated in the north there are two distinct kinds, though similar in their habits, characteristics, and wants, viz: the Chinese cane and the Imphee or African varieties. The former is from the north of China; the latter from the southeastern coast of Africa. Only one kind of the Chinese cane is known to us. That mysterious country from which it comes has hitherto been so completely locked up and barred against all access from other parts of the world, concealing within its own exclusive limits all its light from other nations of the earth, that we are, as yet, almost in midnight darkness as to the richness and value of its garden plants and the methods of culture and manufacture by which they are grown and converted into articles suitable for use. Recently, however, her gates have been opened, and immediately this beautiful plant comes forth and seeks a new home in American soil—a valuable gift to the American farmer. Its first introduction was made in France, and was briefly as follows: Count d'Montigny, in the year 1851, and while he was the French consul at Shanghai, in China, in compliance with official request, sent to the Geographical Society of Paris a collection of plants and seeds which he found in China, and which he thought would succeed in his own country, and among these this celebrated plant which we have in America. It strikes us at once as a curious instance of the manner in which momentous results often depend upon the slightest thread, when we consider that of the package sent by the Count to Paris only one single seed germinated in a garden at Toulon, and that if, by any attack of insects, by injudicious

planting, cultivation or manuring, or any one of a thousand possible mischances, the plant springing from this one seed had been destroyed, France and America might for years have been without knowledge of the Chinese sugar-cane. The capitalist might never have hesitated whether to invest his means in buildings and machinery for purifying its juice, and the farmer never counted the cost of its cultivation. Fortunately the plant grew and escaped all dangers, and in due time furnished the seeds sufficiently matured for subsequent propagation.

The Chinese cane has a very lofty and well-proportioned stalk, with a graceful, bushy, bowing top. Its seeds are of a very dark purple color and almost black. Among the principal difficulties which it has to encounter during its growth are our heavy prairie winds. These winds break and bend the plants to the earth, and when broken or bent they seldom make good sirup. The Chinese are more slender and more liable to be thrown down than the Imphee canes. We have never succeeded in making much sugar from the Chinese plant, but it makes a more pleasant sirup than the Imphee tribe and is far more free from acid. Whenever the cane is injured in any way it changes the color of the sirup and gives it an acid taste.

The Imphee canes are from the southeastern coast of Africa, as already stated. Mr. Wray, of England, tells us that there are sixteen different kinds of these African canes. The Imphee tribe, which have been introduced by this gentleman, are certainly far superior to all others for sugar making. Their crystallization is much coarser than that of the Chinese, which is of a quite floury texture; and there is evidently a marked distinction found in our experiments between the Imphee cane and that which is called the Chinese sorghum in respect to their real value for producing sugar, the former giving about seven-tenths, while the latter gives only about two-tenths sugar. The juice of the Imphee is far more limpid, and contains much less of that mucilaginous substance, known among farmers as white glue scum, than that of the sorghum; consequently it crystallizes much more easily, and we believe that there is as much real sugar in the Imphee canes as there is in any of the sugar-canes raised in the tropics. We have taken from one gallon of mush sirup, weighing thirteen pounds, eight pounds of sugar, as coarse-grained as any of southern production, showing that it has sufficient body and capacity for being refined into the best kind of sugar that the market could afford. We are convinced that this work of refinement is merely a matter of time. We have also found that there is a difference between the same canes when grown upon different soils, and that it is not always the best looking cane or that which has grown most vigorously that produces the best results, and we feel justified in these statements from having given particular attention to the nature and requirements of these plants in these respects. Farmers generally have been in the habit of planting their cane upon their richest soil; but experience has shown that the flavor of the sirup from cane grown upon rich soil is inferior to that grown upon a lighter soil, and consequently the important question has arisen, What kind of soil and nutriment is best adapted to these plants in order to obtain sugar and sirup of the best flavor and in the largest quantities? It is admitted that these plants originally grew upon a brown, loamy, sandy soil, and we may therefore very reasonably conclude that this kind of soil is best adapted to their natural wants, and experiments have shown that our best flavored sirup comes from cane grown upon this kind of soil. It has also been shown that the sirup from cane grown upon such soil has a much stronger tendency to granulation and is more readily converted into sugar. We have frequently been deceived in strong, rank looking cane, and found, upon applying the test of the saccharometer, that it would weigh only from five to six degrees Baumé, and take from ten to fourteen gallons of juice to make one gallon of good sirup; while, under the same test, the cane grown upon a sandy soil would weigh from ten to twelve, and require only five or six gallons of

juice to make a gallon of good sirup. The former, at the same time, would contain a much larger proportion of woody, spongy fibre. It might be supposed that a new, virgin soil would be preferable, but experience has shown otherwise; and that while it would produce a luxuriant growth of cane, it would often prove as deleterious to the saccharine and crystallizing qualities of the sirup as the flat clayey soil. A high, rolling, timber soil appears to be far preferable, no matter if it is worn out for the purposes of our common crops; the cane will nevertheless do well. Subsoiling is found to be advantageous, as the roots of the cane when the land is subsoiled will dive down long distances into the earth. It is not uncommon to find these roots from six to eight feet long, and they will feel for the silex and whatever is calculated to give them their natural support; and, in fact, this soil is found almost equal to the sandy soil, and cane raised upon it produces abundantly of sugar and sirup. If the land is too weak, thirty bushels of lime and one-half bushel of salt will amply compensate for its outlay. In fact, there is no soil on which one can raise a good crop of corn that will not, when properly prepared, produce a good crop of cane. A clay soil, if under-drained, will yield well. All worn and dry soils are very productive, even in dry seasons, and produce the best of cane. The cane never suffers like our common corn. A wet season is apt to give too much water to the stalk; and although it will yield a large proportion of juice, still it will run as low as five or six degrees, and we are much more certain of good results on dry land or in dry seasons. We planted this year a piece of ground that had been laid aside as worn out, and on which we had not been able formerly to get more than one-third of the usual crop of any kind, ploughed ten inches deep, and raised the best crop of cane that grew in the neighborhood. It measured 11½ Baumé.

PREPARATION OF THE SOIL.

Deep ploughing and thorough pulverization of the soil is required by this crop above all others, for the cane seed when put into the ground often lies from three to four weeks, and we have known it to remain six weeks, before it shows itself above the ground; yet one would often find the root six inches in length before the plant had made its way to the light. If the ground is thoroughly pulverized, the infant tender roots will lay hold of the mould without obstruction of clods, and quickly strengthen into vigorous life, and become much more hardy than they otherwise could. Not that it is a tender plant, by any means, for it is really more hardy even than the cabbage plant, and may be transplanted with as much certainty of life; but as the roots of this plant do not, like those of Indian corn, skim along near the surface of the ground, but, on the contrary, dive down deep into the earth, the advantage of upturning the soil and making it mellow to a great depth is readily perceived, since the roots are thereby enabled to pursue their way with less obstruction, and seek out the food and support which the vigorous life of the plant necessarily requires. Besides, when the earth is so stirred, the sunlight, the gases of the atmosphere, and the rain drops, by having more free access, all contribute in developing vegetable life, and producing results that would be impossible while the ground is hard and baked, and the light, air, and warmth are excluded. This principle is illustrated in the instance mentioned of the seed lying in the ground three weeks before making its appearance, as it happens generally after a hard storm pelting upon the ground and making it so hard and dense as to be penetrated with difficulty. In such cases the surface of the ground is formed into such a hard crust that we have sometimes found it necessary to run a harrow over its surface in order to loosen it up, so that the tender plants could make their way through to the sunlight.

SOAKING SEED.

In preparing the seed previous to planting, there may be made a solution of warm water and chloride of lime, in the proportion of three ounces of chloride to twelve quarts of water, in which the seed should be placed and suffered to remain for twenty-four hours, when it may be taken out and put into bags, and covered up in the bags in the earth in a warm, sunny place, where it should remain until it has sprouted. By this process of soaking the seed several days' time may be saved in the growth of the plant; for it will be perceived that the hull of the seed has a very hard, close texture, and the ground being dry it takes a long time for it to swell and break this hull or shell and germinate.

PLANTING AND CULTIVATION.

Plant as early as possible after the ground is in good order, say from the 15th of April until the 15th of May. We planted some this season as late as June, but it did not all get thoroughly ripe. Especial pains should be taken, in planting, to cover the seed lightly and not too deep; for if covered too deep it will be very likely to rot, and, whether the ground be wet or dry, it is much better to cover lightly. We have usually drilled the seeds two or three inches apart, and in rows four feet apart. This does very well if the ground is free from foul vegetation; if not, then it is better to plant in hills, four feet apart each way, in order that ploughing may be done in different directions. The plant generally looks weak and sickly when it first comes up, and strongly resembles the wild grass called foxtail; but although it looks weak and feeble, it is really a hardy plant, and incurs no danger in transplanting. It usually needs such tilling as is required in the case of Indian corn, for the roots of the cane run deep, and there is no danger of its falling down for want of support on the part of the roots. If planted so early that the frost should bite it to the ground, one has only to cut off the dead part, and it soon comes out bright again, and will make a good crop. There are many who sow the seed broadcast like hempseed, and who in this way have produced 500 gallons of good sirup to the acre. We are pursuing this method with some of our fields the present season. We have also had several fields of volunteer cane, which we have worked to good advantage, and have obtained from them a crop equal to that of our common fields. It is frequently advantageous to plant radish seed with the cane, as the radish seed come up quickly, and furnishes a good guide in cultivating the ground before the cane seed is up, which is the very best time for destroying the noxious weeds. It is also the best time to facilitate the growth of the infant roots of the cane plant, and more can be done then to advance the progress of the plant in one day than in five days at any future period, especially if the ground should be beaten down by a storm or rain soon after planting. How important it is that the crust formed by the rain, and the subsequent action of the sun, should be broken up, seems to be fully explained in what has already been stated. Cultivate, therefore, as early as possible, and prevent the weeds from obtaining the advantage. Some advise suckering the cane, but we have found this all lost labor. The Chinese cane, which, in this respect, differs very materially from the African varieties, will often produce from one seed ten or twelve stalks, all equally good and vigorous; or if they differ in size, it will frequently be found that the smaller is the sweeter, and we therefore have been in the habit of permitting them all to stand and grow till the harvest. So far as our observation has extended, the Imphee cane produces only one stalk from the seed, and never stools like the Chinese cane. We usually plant from six to twelve seeds in each hill.

MANURING.

In speaking of the soil, we have said that it frequently happens that it produces too rank a growth. Whenever this is the case, we find little or no tendency to crystallization in the sirup of the cane; and whenever horse manure or hen or pigeon manure has been used in our experiments in cultivating the cane, we have always found it impossible to convert the sirup into sugar. It would be better to use no manure at all, unless we can employ that kind which the nature of the plants require. Crushed cane or bagasse strewed in the path of the plough, and covered by the next succeeding furrow, is a very excellent stimulus to the new growth. We have also used ashes, lime, and plaster of Paris, all of which have very much aided in the growth of the crop, and the free granulation of the sirup; and here we cannot but repeat our regret for the want of knowledge that exists as to the nature of the soil on which this plant has been grown and the culture it has received in the country of which it is a native, and continue to feel that if we could have possessed this knowledge we might have been far in advance of where we now are, after the labor and expense bestowed in experiments during the last seven years of our lives. Why should not the farmers of the west call upon the government to assist in taking some action in this matter? Is there any way in which the Agricultural Department at Washington could spend money to better advantage than in sending an experienced agent to the countries from which these canes have originated, for the purpose of obtaining all possible knowledge concerning these important accessions to the agriculture of our country? In our estimation, such knowledge would be invaluable to the American farmer. It is, in fact, one of the wants of our community, more sensibly appreciated when we behold the struggle encountered and the progress made during the last half century with the sugar-cane at the south.

HYBRIDIZATION.

We have often been cautioned against planting the canes in a field contiguous to one containing broom corn. They rapidly mix, and from this cross there result numerous canes having much pith with but little juice, and that of such an inferior quality as to its sweetness as to make the crop an unprofitable one. Constant care, therefore, must be observed, not to allow scattering stalks of broom corn to be grown near the sugar-cane, and should any stalks indicate that the seed is impure, the selection of the seed for the next planting should be made in parts of the field where the seed is evidently pure.

HARVESTING.

When the crop is very large, it may be advisable to commence harvesting while the cane is in the blossom, as a handsome sirup can then be obtained; but it will be more difficult to divest it of the cane taste, and the amount of sirup will be less than when the cane is ripe. The sirup will not make sugar if the cane is cut before the seed is in the dough. It is well to try different portions of the field by applying the saccharometer, when it would probably be found that in some parts the sirup would weigh five degrees, at another part seven, and at another point nine, and of course it would be advisable to commence work at the latter point. The crop should be allowed to stand in the field as long as possible, without being in danger of frost; but if this enemy is approaching too rapidly, then hasten to cut the whole crop, blade, top, and all, and throw it into winrows, and cover it with straw, or bagasse, if possible, so that it may not be subjected to the process of freezing and thawing. If there is sufficient time, it is better, however, to strip the leaf and top the

cane just below the first joint, and put it immediately under sheds near the mill, so as to prevent its being soured by the action of the sun, or by heat and cold. When the cane is bitten by the frost, the sap, in such case, has a bitter, nut-gall taste, and imparts the same to the sirup, and produces what is called by many scorched sirup, containing a bitterness offensive to the taste, and very difficult to remove. The cane should be cut and brought to the mill and crushed on the same day; and the topping of the cane and stripping of the leaves from the stalks should proceed no faster than it is cut and brought to the mill, if the very best results are desired, and all danger of souring is to be avoided. The juice when expressed should be immediately run into sirup. If the cane is stripped, and suffered to stand afterwards in the field, the juice in the stalk imbibes a bitterness from the wounded portion of the plant, and the sirup will have the unpleasant taste of having been scorched. It is much better, therefore, not to give the cane any rest, after being stripped and topped, till the juice is expressed and run into sirup. When the cane is broken down, or bent and damaged by the prairie winds, as is often the case, it should, for the same reason, be immediately taken to the mill and crushed, otherwise it will be of but little account for sirup. When the cane is ripe, it should be immediately cut, for, if suffered to remain after it is ripe in connexion with the roots, a deteriorating effect upon the quality and flavor of the sirup will be the result, and at the same time the quantity will be greatly diminished. A common corn-knife may be used for stripping the cane, and with it one man can strip an acre per day, if he is not required to save the leaves or blades. If the cane when cut is put into packages of twenty or thirty stalks each, and tied up with a couple of bands, it will assist very much in handling afterwards. If the cane is ripe, it may be cut and housed from the wet and frost, and if properly taken care of it may be kept for some time, say till the last of December, and will frequently improve by being so kept, and often shows a weight of fourteen Baumé. A dumping cart is very useful in handling the cane, and will save a hand to each team.

MILLS.

A good mill in this business is a thing of the greatest importance; for if that breaks down or stops, the work in all its departments must stop; but when that goes and performs well its part, then all other parts of the work must move briskly forward. The mill, therefore, needs to be well and thoroughly made in all its parts, for no time should be lost in mending or repairing after the work has been once commenced. Its capacity should be graded according to the extent of the crop. If one has twenty-five or thirty acres of cane, he needs a mill capable of expressing 150 gallons of juice per hour, unless he expects to run both night and day. We have heretofore used a mill manufactured in Cincinnati, but consider it susceptible of improvement, and shall endeavor to improve upon it hereafter. A mill that will express 250 gallons of juice per hour may cost a little more at the outset, but as it costs no more to attend it, and as the same number of hands can run it that would be required to run one that would express only 50 gallons per hour, we believe it would really be a saving of expense before the season was over to lay out a little more money in the beginning. While a small mill would only make about forty gallons of sirup per day, a large one, with a very little more expense, would make 150 gallons per day.

HANDLING THE JUICE.

A tunnel sieve may be used for conducting the juice from the spout of the mill to the filterers over the pan, and this renders handling unnecessary until it is passed into the evaporator, where it should be concentrated to 15° Baumé.

It being then thoroughly defecated, it is then passed, while hot, through three tub filterers, set directly over each other, and which may be of the following dimensions, viz: three feet deep, three feet square at the top, and two feet square at the bottom, which is perforated with flannel over it upon bars, then filled with bone-black or animal coal. These filterers should be so placed that, by turning the cock, the liquid can be run off into the last concentrating pan; then drive the fire till the saccharometer indicates 40 while hot; then run it off into a large flat cooler, which will hold the labors of the day, without having the sirup more than two inches deep in the cooler when hot, lest it should scorch, as there is more danger here than over the hot fire, where the boiling and commotion give it no time to burn.

EVAPORATING PANS AND CLARIFYING.

If Cook's evaporator is used, it clarifies and makes the sirup and sugar without the aid of another pan, or the assistance of any chemical agents, and thus is preferable for a small business to almost any other pan with which we are acquainted. If one uses a pan of this style, (two would be needed,) it may be 25 feet long; the width of sheet iron 28 inches, 3½ feet at the top, and made flaring. It should be partitioned off into three divisions, and be set upon a continuous brick arch 15 inches wide, and the fire should hug close to the pan. In this way 100 gallons, at least, of good sirup can be made with half a cord of wood. One will need, however, with this pan, a defecating pan to receive the strained sap and clarify it as above described, and this clarifying pan will keep the long pan at work. But if one wishes very nice sirup, he should run the clarified sap, while hot, directly into the filterer, say a tank seven feet high and four feet in diameter, with a perforated bottom, and with a cock twelve inches from the bottom, to turn the juice from the tank into the pan; place bars upon the perforated bottom, and a flannel cloth to keep the dust or coal from mixing with the juice; then put in three feet of animal charcoal or bone-black, and spread a cloth over it, and put two feet of wood coal upon the top of this, about as fine as shelled corn, and let in the juice. When ready to start the long or finishing pan, turn the cock and let on the filtered juice as fast as it may be required.

DISPOSAL OF THE SCUM FROM THE EVAPORATOR.

The scum is worthless till the juice is concentrated to about 15° Baumé, except to feed to stock. They are very fond of it, and devour it greedily. After this, one can save the scum by putting it into a tank for that purpose, and at leisure, after it has settled, draw it off and run it over the pan again, till the juice has arrived at about 20, when the scum will produce as fine-flavored sirup as any. It might be well to run it through the filters, and the scum taken from this will make good vinegar. In fact, if all the washings are saved, ten or fifteen barrels of good vinegar can be made in manufacturing thirty or forty barrels of sirup; or, if something stronger is desired, an excellent brandy can be made, from all fermented saccharine juices, that is worth from two to four dollars per gallon. Forty gallons of this juice will make four of good spirits.

DRAINAGE OF MUSH SIRUP INTO SUGAR.

This is the most difficult part of all our labors, for it does not naturally drip dry. The quickest and most successful way we have found to obtain sugar is to put the mush into a coarse, strong bag, and put it into a strong hoop similar to our common portable cider-mill hoop; then put on the pressure of the screw, and if the room is warm the molasses will soon leave dry sugar. Another

mode of drainage is to have a large table, say twelve feet square, with sides four inches high, and the centre as high as the sides, and gradually sloping to the corners, where a spout should be placed to carry off the molasses; if the room is kept warm it will soon drain to dry sugar. By either mode clean, dry sugar will be obtained, free from any cane taste, as that leaves with the molasses.

DISTILLING THE CANE JUICE.

It is well known that when sweet cider ferments and becomes hard and sour, it will make spirits called cider brandy. If the saccharine qualities of cider are measured, it will be found about 7° Baumé. Good cane juice runs from 8 to 12, and, when fermented, it will, by distillation, make good brandy. It must not, however, in this case be soured to vinegar, for that will not produce spirits. The method of distilling is a very simple one. A copper still, which will hold, say, 300 gallons, will make 32 gallons of brandy, worth from two to four dollars per gallon. This still, set in an arch with a water tank and a lead worm-pipe in it, the pipe being connected with the still head, and the still being full of juice, connect the worm-pipe with the still head-air tight; then start the fire, and the condensed steam will commence running out in the form of spirits—and this is all there is of it. But in fermenting the juice long vats are needed that will hold one hundred barrels or more. Let the juice stand, if warm, from eight to ten days, and it is then ready for distillation. Several of these vats might be needed. It will be perceived, therefore, that fermented juice, sour sirup, and even scum from your sugar-works, may all be worked up eventually into spirits. From eighteen hundred to two thousand gallons of juice may be produced from one acre of cane, and, if distilled, about fifty gallons of good brandy may be obtained, worth four dollars per gallon, at least. Heretofore, corn, barley, and rye have furnished to our nation the bulk of its spirits; but, by employing the cane, these grains may be saved for other purposes; and if the cane juice is so much more economical in the production of alcohol, we may look for a great revolution in this respect. But while we would advocate its advantages over all other articles capable of distillization, we would by no means be understood as advocating its use in form of distilled spirits as a beverage; we only point out its capability of being used for honest and useful purposes.

BAGASSE OR CRUSHED CANE FOR FUEL AND OTHER PURPOSES.

A mill of any capacity will produce bagasse enough to evaporate, when employed as fuel, all the juice to sirup or sugar. On the arch over which the long pan is placed, having a side arch with a flue to enter it, so constructed that there may be a large door to open for putting in the crushed cane by forks full. The freshly-crushed cane will make more heat than the dry; therefore it is not necessary to wait till it is dry before using it. Having two arches, either wood or bagasse can be used. If the chimney is high enough, there will be no difficulty in respect to draught. We have known the flames to pass through the twenty-five-feet arch and out three feet above the top of a chimney twenty feet high. We have a paper mill that already uses largely of the bagasse in paper making; and, as we have already said, it is an excellent article for fertilizing the soil.

SUGAR MAKING AND REFINING.

There is now no longer any room for question or cavil as to the possibility of producing sugar from the canes, nor, indeed, is there any particular difficulty in its manufacture, with suitable conveniences. Ten days' time has

been found sufficient to convert the juice into dry sugar fit for table use. The question may then be asked, what is required for fitting up a suitable manufacturing establishment? In answer to this question we should say, if the intention be to engage in the business upon an extensive scale, and in such manner as to be able to compete with Cuba, the southern States, and the world at large, it would be advisable, first, to visit those places where the manufacture of sugar from the ordinary cane has been heretofore carried on, and ascertain the amount of expense there laid out in constructing the conveniences for such manufacture. One-fourth of that amount expended in constructing similar conveniences at home would, doubtless, be able to drive all competitors from the market. Illinois has already one instance of enterprise in this respect. She has already one establishment costing the party who erected it not less than $75,000, which commenced its operations by working up eight hundred acres of the cane, some of which yielded three hundred gallons of sirup per acre. When we consider that from the comparatively small city of Quincy thousands of barrels of sirup have been exported during the present season, some of it going into the sugar-raising State of Alabama, where least of all it would have been expected five years ago; that large numbers of our farmers during the past season have cultivated fields of fifty acres of cane, with others of eight hundred acres in prospective cultivation; and that the vast area of the great northwest is nearly all adapted to its cultivation, we can begin to have some idea of the works which may hereafter be advantageously erected. Capitalists will, doubtless, soon open their eyes to the importance of this branch of manufacture. Farmers are already inspired with confidence from the success of the past year.

The Belchers of St. Louis and Chicago are always in the market quietly purchasing every barrel of sorghum they can obtain, and in a short time they will return the sirup, refined, to the country, and doubtless receive two dollars for every one they have expended. It is a significant fact that imported sugar now brings from ten to sixteen cents per pound, while molasses brings only from forty to sixty-five cents per gallon—a disproportion of price such as has never before been witnessed, and such as never would have occurred, had it not been for the abundance of sirups produced by our farmers from the Chinese and Imphee canes. At the present prices of sugar, molasses or sirup should sell for from sixty-five cents to one dollar per gallon. It is evident, therefore, that the price of sugar will also receive a fall, as soon as the business of converting our home sirups into sugar shall once be in general and successful operation.

From our own little establishment we have made over four tons of well-grained sugar from the Imphee sirup during the past season, and have found but little more difficulty in making sugar than we have in making good sirup. Our process was simply the one above mentioned, of pressure in the hoop and draining from the table, and for convenience we find the following to answer a very good purpose: A building erected upon elevated ground, in dimensions about fifty feet one way, by from seventy-five to one hundred feet the other way, well covered with a tight roof, and one room in it made tight, close, and warm, the temperature of which should be kept always up as high as 95° Fahrenheit. The building should be made high enough to have a fall of fifteen or twenty feet from the mill, to conduct the juice from the mill directly to any part of the building; otherwise it would require a large receiving tank, and make it necessary to pump the juice up into this from the mill. In this case a very large pump would be required so as not to vibrate or disturb the juice too much, for it easily foams and then ferments readily. The clarifying pan should be placed highest, to receive the raw juice first and defecate it, next the filters, and then the concentrating pan. By this arrangement much labor in handling the juice will be saved. Have a horse and sled placed under the mill

to remove the crushed cane out of the way. About an acre of ground is required to afford room for the building and the sheds to hold the cane and keep it from the sun, wet, and frost, and for a place to store the bagasse. With these conveniences one can commence operations, and, as the juice of the cane passes through the tin pipe from the mill to the defecating or heating pan, bring it to a boil, and concentrate it to twelve or fifteen degrees, removing all the green scum; then to every forty gallons of juice run from the heating pan while hot into a flat box or tub, put in ten or twelve pounds of pure pulverized clay; stir it up gently, and let it stand ten minutes to settle, then draw off from the faucet, leaving the clay and sediment at the bottom, and continue in this way, as the juice may be needed to fill or feed the last concentrating pan. By this process will be obtained a fine sirup, or sugar, as the case may be, and according as the Chinese or Imphee cane has been used. Instead of this clay process, filters containing animal charcoal may be used, as previously described. We have sometimes used clarifying agents, such as sulphate of lime, &c., but do not like them, and believe it better to dispense with them, though they might be found of some service in removing the acidity of the juice. For crushing the cane we have used an iron mill manufactured in Cincinnati. This mill crushes the cane between perpendicular iron rollers, and can be used with two or four horses. It expresses from one hundred to one hundred and fifty gallons of juice per hour, and is the best we have ever seen.

USES OF THE SEED.

There is evidently a coloring principle contained in the seed, and in Europe it is much used for coloring purposes. When the seed is fed to animals, it will be noticed that their excrements will be tinged with a purple color, which is probably derived from the hull or shell of the seed. It also makes a good article of starch. A prejudice has existed among many that it is poisonous as an article of food for stock, and they have, therefore, left their seed upon the ground to rot. But the season of bugbears on this subject has nearly passed, and farmers are beginning now to be as careful of saving the seed for their stock as they would be of corn or oats. We fattened two hogs last year exclusively upon this seed, and never had firmer, nicer, or better pork, and entirely free from discoloration. We have also fed it to horses without any other grain, and found them to be very fond of it, and to thrive upon it as well as when fed with oats. All kinds of stock eat it greedily when they have become accustomed to it. It makes a very handsome flour that is almost as white as wheat flour; and in fact there is no grain except wheat that makes a better loaf of bread or cakes in any form it is cooked than this cane-seed. We speak confidently on this point, because we have tried it.

DIFFERENT KINDS OF CANE.

Of the Chinese cane we have known but one description, as before stated. We have cultivated six different kinds of the African canes, viz:

The E-en-gha: this has a fine, tall, slender, but beautifully proportioned stalk; has a large, graceful head, with seed large and of a yellowish hue. It is a very sweet cane, and will ripen in from ninety to one hundred days.

The Nee-a-az-na: seed-head very bushy, and seeds black to all appearance; seeds are large and plump. It is the earliest cane we have, and ripens in ninety days at least. It is also one of the sweetest canes we have, and yields at least seventy per cent. of sugar.

The Oomza-ana is an early cane, and ripens in any latitude where Indian corn will; has a good-sized stalk; seed-head very close, compact, and erect; the stalk is sweet, and yields about seventy per cent. of sugar.

The Boom-viva-na: a very nice, sweet cane, and resembles the E-en-gha in growth and appearance; ripens in ninety days.

The Shla-qua-va ripens in about three and a half months; very juicy and sweet; seed-head stands well erect, colored pink; an excellent quality of cane.

The Boo-ee-ana: small-sized cane; never falls down; very rich; makes eleven degrees Baumé; ripens in three and a half months, and makes good flour.

In the perusal of the foregoing pages, it must be remembered that we make no pretensions to professional or scientific discussion upon the nature or merits of the sorghum. We have merely drawn from our own experience, believing the information which is founded upon actual experiments to be more useful than theories built up without the test of actual experience. We leave it to others, whose means and opportunities are more favorable, to construct such theory as shall best illustrate and harmonize with the truth, and take pleasure in furnishing, so far as we are able, the rough timbers required for the edifice.

CULTIVATION OF THE SORGHUM.

BY L. BOLLMAN, BLOOMINGTON, INDIANA.

In compliance with the request of the Commissioner of Agriculture, I forward to the Department some specimens of sorghum molasses, made in the county of Monroe, Indiana, with such remarks on the character of the soil on which the canes were grown, the yield, quality of the molasses, kind of cane, and on such other matters as may aid, in connexion with the analyses that are to be made of them, to accomplish what we all so much desire: the making of sugar profitably from the sorghum.

GENERAL CHARACTER OF THE SOIL.

The Louisville, New Albany, and Chicago railroad passes through the entire length, north and south, of Indiana, a distance of 288 miles. The south half passes over an undulating surface, resting on white, crystallized lime rock. The soil is a drift. On the rock is a square flint gravel; on this, a deposit of red clay, and, in large portions, another deposit of yellow clay on the red clay. Sand, to a limited extent, is mixed with this yellow clay, but on the higher portions of it there is considerable loose and small sand rock, from the disintegration of which a good deal of sand has been mixed with the soil; in a few places, where it has been washed down, there is more sand than clay. Monroe county lies in the highest portions of this limestone region, and on this account is attracting much attention as a superior fruit-growing district, for supplying the wants of the level country which lies beyond it to the north, and reaching to the furthest settlements in Minnesota. Some of the canes of these specimens were grown where there was sand rock; others where there was none.

THE NUMBER, QUALITY, ETC., OF THE SPECIMENS.

No. 1 was raised on good soil, clay loam, with loose sand rock in it, inclining gently to the north. The seed was mixed Imphee of the fourth crop from the imported. It produced broom corn with long brush and short, a few heads of white Imphee, but nineteen-twentieths were apparently of a complete cross between the Imphee and Chinese varieties. It grew as tall as the Chinese, but

had the dark green leaf of the Imphee, with the long and dark chaff of the Chinese. The seed was not planted until after the middle of May. A sharp drought was prevailing at that time, but with some appearances of rain. To hasten its coming up I sprouted it, by mixing sifted charcoal of about one-third of the bulk of the seed with it and freely watering it. In forty hours I unexpectedly found the seed sprouted from a quarter to a half inch in length of both the stem and root. I sowed it in drills, very thickly, and as the weather continued dry, it came up enough to make a stand of about six inches apart in the row. Simply soaking the seed in dry weather is much more advisable than sprouting it. The ground occupied was 12,600 square feet, a little more than a quarter of an acre, the rows being three feet apart. It was hoed once, ploughed three times. The yield was but 16 gallons.

No. 2 differed from No. 1 in this only: the ground was level, lying better to the sun, and did not contain more than two-thirds the number of canes to the row. The ground was 11,340 square feet—about a quarter of an acre—and yielded 23 gallons. The molasses of these numbers was not kept separate, and is as dark in color as the Chinese specimens, but very full of sugar. The canes were not cut until towards the end of October, and made up in the beginning of November. *The stalks and blades had turned very red.* The sugar commenced forming in about four days, and gave strong indications of leaving but little molasses.

No. 3.—This molasses is from the Chinese variety. The ground contained 19,404 square feet, yielding three and one-half two-horse wagon loads of canes, which, with a load and a half from other grounds, yielded 61 gallons, estimated at about 110 gallons per acre. The seed was planted about the last day of April, in moderately good soil, with considerable sand and gravel beneath, almost in reach of the plough. It was planted in hills about three and one-half feet apart, and as the seed came up badly it would not average more than two stalks to the hill. The exposure was very fair to the sun. The cultivation not very good. The cane was cut a few days before that of Nos. 1 and 2, but was red before cut up. It was to the taste the clearest and strongest sweet of any cane brought to the manufactory, worked better, and contained a great deal of sugar. The specimen does not show its full proportions of sugar, as it had deposited a good deal of it at the bottom of the bucket from which it was taken.

No. 4.—Ground, 23,322 square feet, a little more than half an acre; yield, 106 gallons, or about 200 gallons per acre. The seed was Chinese, and the canes the best grown of any I have seen this season. The soil was a new, rich, clay loam, with some sand but no sand rock; the cultivation good, and the canes grown in hills four feet apart each way, with nearly five to the hill. The seed was planted on the 15th of May, and the canes cut up and manufactured in the end of September. The molasses is thinner than other specimens, being made in a common sheet-iron pan; all the other specimens were made by Cook's evaporator. It does not show any sugar, which I attribute to its being too thin, but especially to the cane being cut up too soon. The molasses is the mildest I send, partly because it is from the Chinese cane and thin, and it may be from the potash of the soil neutralizing the natural acids of the cane. The trees of the ground had been deadened and enclosed, when a dense thicket grew up, which, after some years' growth, was cut down, grubbed, and burnt, thus making the soil abound in potash. The large yield might have been influenced by the abundance of this substance. A larger portion of the top of the cane was cut off than usual in order to get it into the wagon-bed.

No. 5.—Ground, 45,198 square feet, being a little more than an acre, planted with the Chinese variety about the first of May, in hills nearly four feet apart each way, thinned out to four stalks in a hill, but when cut many contained from five to six stalks. The yield was 99½ gallons. The cultivation was

good, but a dense woodland was on the east side of the ground, which injured the first eight rows, and I have no doubt impaired the quality of all the cane, by intercepting the morning sun. The soil was good, having a small portion of sand but no sand rock. The amount of cane and the cultivation of Nos. 4 and 5 were more nearly alike than any other. The variety was the same, but the chief difference was in the quality of the soil. The yield of No. 4 was double that of No. 5, and making every allowance for the molasses being somewhat thinner, and the shading of No. 5, yet to the soil must be attributed the chief part of this difference, thus showing that the sorghum follows all other plants, yielding more bountifully as the soil is more excellent. No. 5 does not show any sugar. It was cut some ten days later than No. 4, but had not turned red.

No. 6.—Ground, 21,870 square feet, nearly half an acre. The soil was excellent, having produced only four crops. It had no sand rock in it, but its exposure was well to the sun. It was planted with the white seed Imphee. This is, perhaps, the pure Imphee. It does not grow more than two-thirds the height of the Chinese; the brush is much shorter; the amount of seed is double that of the Chinese, having a light color, varying from that to a reddish brown, according to its age, the full development of the cane, and its exposure to the sun and weather. It was planted very thick about the 1st of May, four feet apart, and the hills but twenty inches apart in the row, with about five stalks in the hill, equal to the canes being but four inches apart if planted in a drill. It was well cultivated, not harvested until of a red color, but it has failed to show any sugar, and yielded only 32 gallons. I attribute this to the very thick planting, and the variety of cane. This cane had a flat, insipid taste, was too short to yield well, and is regarded by all here as unprofitable on account of its small yield, but is generally believed to have better sugar-making qualities than the Chinese.

No. 7.—This and the following two specimens come from a different part of the county, but the soil has the same general composition. It presents the finest sugar qualities and is of a lighter color than most of the specimens, for it is of the white seed Imphee variety. It fully bears out the general preference given to this variety for sugar properties, but the yield is much less. I could get no particulars of its cultivation, as I procured it from the manufacturer.

No. 8.—This is also from the white-seeded Imphee, and is equal to the preceding number but not quite as thick. It is mostly sugar, of a light color, but the yield was at the rate of only about 60 gallons to the acre. It was produced from moderately good soil, well cultivated, and planted in hills four feet apart, with four canes to the hill.

No. 9.—This is a fine article of molasses from the manufacturer, taken from one of the barrels which contained the mixed product of several lots. It is sent as a specimen of our general manufacture, but was made by Mrs. Sharpe, the best manufacturer in the county, and whose intelligence and zeal for the success of sugar production are an honor to her, no less than the specimens, Nos. 8 and 9, which were made by her. No. 9 is from the Chinese cane, very thick and pure, but shows no sugar, from the fact, probably, that the barrels are full and kept in a cool cellar. The most productive cane made up by her yielded 173 gallons to about $1\frac{1}{4}$ acre, planted in hills three and a half feet each way, with five canes to the hill, in good, but old ground. The matters I have stated relative to these specimens give rise to some important inquiries, most of which I will consider under the general question—

WILL SORGHUM BE A PROFITABLE CROP?

The answer depends very much upon the final success in making sugar of it. But upon the supposition that but little or no sugar is made, let us see what the production per acre is, and the cost of manufacture, and the raising and hauling of the cane. We have had many statements of the large yield of sorghum molasses to the acre. These place it from 250 to 300 gallons. I am told that in this county at the rate of 400 gallons have been made, but it is doubtful if more than 200 gallons can be made. The four best yields, as stated, are 100, 110, 138, and 200 gallons per acre, the average of which would be 137 gallons. No farmer can raise an acre of it and haul it to a neighboring mill under $25. This would be 18¼ cents per gallon. It is usually made here for the one-half. Upon a medium sized Cook's evaporator about 30 gallons can be made each day, requiring, at the very least, three persons, two horses: all the wood previously cut, seasoned, hauled, sawed, and split. Five dollars per day, or 16⅔ cents per gallon, are the very least that would pay for these and the interest on the fixtures. The cost per gallon, without including the barrels, would therefore be 35 cents. This is very different from the 20 and 25 cents so often stated. To the farmer this is cheaper than the ordinary Orleans molasses at the same price per barrel, for it substitutes labor for money. In the above estimates I have not considered the value of the seed and fodder, but have placed them against the stripping and cutting. Beyond the home consumption of the farm-house, I doubt whether sorghum molasses will ever be used, for such consumption will so materially lessen that of the Louisiana cane, that the latter, in its best refined condition, will be cheaper, and preferred by the city and town consumers. Our expectations of making it an important commercial crop rest on the sugar-producing qualities of the sorghum. At present we see but darkly, and the specimens I send do not enable us to see more plainly, but they strengthen my hopes. Of the nine specimens I send, four show a good deal of sugar, and I have referred to the probable causes why the others do not—cutting the canes before fully ripe, and keeping the molasses in full barrels placed in cool cellars. If we are to have our hopes realized, it must be by the observance of two things: the proper management of the cane in growing it, and its manufacture. I will limit my remarks almost entirely to the first of these, leaving the manufacture of molasses and sugar to such close-observing, zealous, and experienced manufacturers as Mr. Hedges, of Dayton, Ohio.

THE PROPER MODE OF GROWING THE SORGHUM.

If there was anything in the nature of the sorghum that precluded its making sugar, then no cultivation would be successful. But the analysis of this cane gives every encouragement, and it compares with the Louisiana cane and sugar beet as follows:

	Sorghum.	Sugar-cane.	Beet root.
Water	75.6	72.1	83.5
Sugar	12.0	18.0	10.5
Woody fibre and salts	12.4	9.9	6.0

Of this 12 per cent. of sugar, 10 is crystallizable and 2 not. Other analyses show a greater per cent. of sugar—several as high as 16 per cent. But this amount depends much on the condition of the plant, both as to its cultivation and its ripeness when cut. Dr. Jackson, of Boston, has made some analyses of much interest, the results of which are sustained by these specimens. Unripe canes, being cut when they were about to blossom, gave 11 per cent. of sugar, *but none of it would crystallize.* Other canes, cut when they were just flowering, were found to have no sugar that would crystallize. The same result was obtained from canes which had done flowering, and in which the seed had

begun to form. All these canes had much gum and dextrine, as well as acids. "Sirup," says Dr. Jackson, "is not liable to crystallize, owing to the presence of acid matter." Writers on vegetable physiology state that sugar is formed by a subsequent transformation of gum and dextrine, so that unripe canes have these, but only a limited amount of sugar; and sugar is of two kinds—cane sugar, or that which crystallizes, and grape sugar, which does not. The latter has more water in combination with its carbon, which it seems to lose as the plant ripens, thus forming it into cane sugar. Hence Vilmorin, of Paris, a man devoted to agricultural matters, says: "The crystallization of the sugar of the sorgho, it seems, should be easily obtained in all cases where the cane can be sufficiently ripened."

Dr. Jackson analyzed sorghum canes in November, but when cut is not stated, except one was "nearly ripe, and another quite ripe." These gave results, showing from 12½ to 16½ per cent. of sugar, which crystallized well, having but little molasses. The specimens I have sent corroborate these deductions of analyses and vegetable physiology. The late cut canes are forming sugar; those early cut are not; and in no instance have I learned of canes cut in September or early October forming sugar. Here, then, we have two important facts shown: first, that the sorghum cane has a large amount of crystallizable sugar when well ripened, and that if not well ripened, its sugar will not crystallize.

WHAT, THEN, CONSTITUTES A WELL-RIPENED SORGHUM CANE?

The answer includes every requisite essential to a perfectly developed plant. But, practically, many overlook some of these requisites. All know when a corn plant is well and perfectly matured by the size of the ear, the hardness of the grain, and the appearance of the shuck that envelopes it. But we cannot see the amount and quality of the juice in the sorghum plant, and hence the canes are hurried to the mill as fears of frost may urge, or pressing work demands. These requisites are:

1. *A rich soil.*—From mere size of the canes, and the apparent sweetness of the juice as determined by taste, I had almost come to the conclusion that a rich soil was not essential to a perfect growth of the sorghum; but the greater yield of No. 4 over No. 3 convinced me that it was like most products, best when matured, and yield most when liberally sustained by a rich soil. It does not require as much vegetable matter or humus as corn does, because the use of humus to corn is two-fold, to yield carbon to the plant and protect it from drought; but the latter purpose is not so essential to the sorghum, as it sustains the severest drought, its evaporations being much less, I presume, than corn; but as sugar is composed largely of carbon, the soil must contain enough carbon to aid that of the atmosphere, which does not exist in sufficient quantity. The mineral or ash ingredient necessary to the sorghum plant may be learned from analysis, and I give the following of it and corn, that a comparison may be made. The analyses of the sorghum have not yet been sufficiently numerous to determine its mineral ingredients under the best cultivation, but I have selected the best within my reach.

	Grain of corn.	Stalk.	Grain of Chinese cane.	Sorghum stalk.	Bagasse.
Phosphoric acid..	44.57	17.08	26.960	9.122	13.42
Sulphuric " ..	12.77	1.19	0.888	3.851	28.70
Lime	1.44	7.98	0.800	16.993	11.80
Magnesia	16.22	6.64	14.320	1.435	9.60
Potash	32.48	9.62	16.240	15.179	8.10
Soda	....	16.30	9.080	7.267	9.60
Silica	1.44	26.97	40.300	42.927	14.40
Chlorine	0.18	3.42	0.072	.846	3.70

The difference is readily seen. Corn requires more phosphoric acid, but sorghum much more sulphuric acid and lime; and as gypsum is composed of these, a clover crop, well manured with gypsum, would make a most desirable fertilizer for the sorghum. It requires potash, also, in considerable quantity, and much silica, as is easily seen by the eye from the glazed appearance of the stalks and blades. The large amount of silica in the grain of the sorghum is doubtless a mistake. The analyses of the stalk and bagasse, which ought to be the same in results, were both made by Dr. Jackson in different years, and their great difference shows the necessity of more extensive examinations.

2. *Early planting.*—A plant so much abounding in sugar must require from its nature a long season to fully develop its saccharine quality. The Louisiana cane has nine months, and, then, but from three to five feet are used. Early apples are all deficient in richness of juice, and cider apples must be either winter or late fall apples. To make good wine the grape must be grown with all requisites for perfect maturity, as young, vigorous branches, good cultivation, and exposure to the sun. If the sorghum has nearly one-third less sugar than the Louisiana cane, it may have a proportional shorter season, and this would be not less than six months from the beginning of May until the end of October. If Nos. 1 and 2, which were late planted, show sugar, it is because they were not cut until the end of October, and the present season has been a most remarkable one for rapid maturity of all our crops. In ordinary seasons the results would have been different.

3. *Good cultivation.*—This embraces not only breaking up, harrowing, and ploughing, but exposure and thinning out. Heat is essential to the transformation of gum and dextrine to sugar, and to the general maturity of the plant; hence the ground for sorghum should have a fair exposure to the sun from its rising to its setting. It should not incline to the north, but, if possible, to the south, especially where the soil is clay. The yield of No. 5 was much decreased by the woodland on the east. Thinning out must be carefully attended to. If planted in drills, they should be four feet apart, and the canes a foot apart in the drills. From statements made in the papers the tendency is to crowd too much; but every farmer knows that corn, in the best soil, should not have in this latitude, (that of Cincinnati,) more than three stalks in a hill when these are from three and a half to four feet apart. Many Louisiana planters find it best to have their drills eight feet apart. Their experience is that to make sugar good the cane must have room. The juice of No. 3, was the best I tasted, attributable to no other perceptible cause than its thin standing. The Imphee molasses of No. 6 does not show sugar, and from no other perceptible reason than the crowded condition of the canes. Good cultivation of this crop most positively includes an early and complete hoeing, especially where foxtail grass is one of the pests of the farm. The weakness of the plant during its first month imperatively demands the kindest care that can be bestowed upon it. As soon as the plant has thrown out its four side or surface roots, it begins to grow rapidly, and when these are doubled in number suckers begin to come out. Many advise that these need not be taken off, but in this I cannot concur. They certainly take from perfection of the main stock, and when it is ready to cut the suckers are not matured. Farmers are often advised to reserve these for molasses only; but when the suckers are permitted to grow, not one in twenty farmers will separate them. The cutting season finds them with a pressure of work on hand, and the time necessary to separate the suckers will not be given; and sugar cannot be made if immature canes are mixed with those that are fully ripe.

4. *The proper time for cutting.*—Cutting includes three things—stripping of the blades, topping, and cutting from the roots. It is the practice of many to strip the blade some time before cutting, but this is wrong. When the blades are taken off, the sap ceases to circulate, and much unelaborated sap remains

in the plant. If warm weather follows, there is great danger of fermentation. The operations of nature should not thus be interfered with. Stripping, topping, and cutting should be done at the same time.

Where the topping should be made I am unable to state, for we have had no analyses, that I have seen, of each joint of the cane, to determine their difference. The blades of the Louisiana cane die from the ground upwards, and I have seen the statement that they use no higher portions of the cane than to where the blades are dead, being, as already stated, from three to five feet in length. We cut the sorghum according to the length of our wagon beds. Sugar-making will require more attention to this matter, and we must call in the aid of the chemist. But the specimens most clearly teach us the time for cutting. No sugar is formed, in any molasses I have seen, when the cane was cut in the end of September, and in the beginning of October, *or when the blades and canes had not turned red.* Analysis, it is true, tells us that the plant contained crystallizable sugar when the seed is ripe; but to get it to granulate is more difficult than to determine its presence by chemical tests. The redness of the canes and blades is like that of the leaves of our forest trees in autumn—the indication of the ceasing of circulation of the sap. This is a gradual process, and not until it is completed is the plant at its maturity. I commenced stripping early in October, but upon comparing the taste of the sap of the riper with the less ripe canes, I could easily see the great difference, and this difference continued until all the canes had become red. *No stripping or cutting should be done until the cane has turned quite red,* and this period is from the beginning of the third week in October in this latitude. Whether topping, as we do in tobacco cultivation, before blossoming or at a later period would be advantageous, has not been tried; but, as the seed is valuable, farmers would prefer its maturing, unless such topping would insure the formation of sugar. The Louisiana cane does not flower, its sugar has the entire strength of the plant, and it is said when it is allowed to go to seed in Central America this natural process interferes with the development of the saccharine materials. With the cutting and hauling the labor of the farmer ceases, and that of the manufacturer commences. As already stated, it is not my intention to speak of this branch of the subject, only so far as the duty of the farmer is connected with it. It is a matter of interest to both to have the question determined:—

HOW LONG MAY THE CANE BE KEPT AFTER BEING CUT UP?

Reports have been made to our State board, stating that it may be kept unimpaired from four to six weeks. Others think that the first joint from both the top and bottom cuttings is soured and should be cut off. The only analysis to determine this point that I have seen is that made by Lawrence Smith, of Louisville. He says: "Even on the surface which is cut an alteration commences at once; the sugar is changed, and this alteration gradually creeps from the cut extremity into all the joints of the stalk. I have verified this fact in relation to the sorgho." By examining different joints, after it had been cut two or three weeks, the results were as follows, the joints being numbered from the extremity next to the roots:

Juice from joints.	Crystallizable sugar.	Uncrystallizable sugar.
First joint contained	6 per cent.	7 per cent.
Third joint contained	8 "	4½ "
Fifth joint contained	9⅓ "	3 "

Nothing is said of the ripeness of the cane or of the condition of the weather—two things that would materially influence the character of the juice—nor of the mode in which it was kept. The Louisiana cane is kept several weeks by throwing it into winrows after being cut. The cane is protected from frost by the tops and blades, which are carefully piled over the stalks, and the water

carried off by giving the stalks an inclination of three to four feet. But this method will not be adopted here, because the seed and blades are wanted for stock feed, and the blades are two few and narrow to afford much protection. It is better to work it speedily, and for this purpose our mills must be increased, so that every neighborhood may have its cane worked up in about three weeks.

The foregoing communication was written last winter, and having had the pleasure of examining the analyses of the specimens I forwarded to the department, I desire to refer to them briefly here, to show the correctness of the views I have advanced as to the absolute necessity of growing a perfectly matured cane.

By the report of the chemist, it will be seen that No. 3, although it had deposited some sugar before sent, which was not put in it, yet subsequently deposited more than any of the others. The cane from which it was made was planted very thinly, and was well matured when cut. No. 4, which was cut in September, although it had the best soil and cultivation, but too thickly planted, yielded only a few undeposited grains of sugar. It contains but one more portion of cane sugar than No. 1, although the latter had deposited one-third its bulk of sugar. In all respects, but too early cutting, No. 4 was much better cane than No. 1. No. 5 possessed no better sugar qualities, chiefly for the same reason; but Nos. 6, and 9, although containing no sugar when sent to the Department, yet deposited much afterwards, evidencing that I was right in attributing their not showing sugar when sent, to the fact that the molasses had been kept in full barrels and in a cool cellar. The granulating process requires air and warmth, and perhaps light also.

To me it is obvious that the chief requisite for sugar-making from the sorghum canes is their *perfect maturity*, and such maturity is dependent on correct cultivation and late cutting.

WASHINGTON, *June* 4, 1863.

SHELTER AND PROTECTION OF ORCHARDS.

AMONG the many subjects of interest to the fruit-grower there are none that so imperatively demand his attention as those of shelter and protection to his crops; certainly there are none that present a greater prospect of increased remuneration in the products of the orchard and garden.

It cannot have escaped the notice of those who are familiar with foreign works on horticulture, that their principal gardens and fruit grounds are surrounded by walls or hedges, showing that protection is deemed essential, or absolutely necessary to secure the best products by rendering the climate more congenial, and approaching more nearly the atmospheric conditions of warmer latitudes.

Allowing that the American climate, at least over the greater portion of the continent, is particularly favorable to the production of fruits, we cannot shut our eyes to the fact that in sheltered city gardens, vegetation commences at an earlier period, and, as a consequence, fruits ripen earlier, and in many instances attain a greater degree of perfection, and are less liable to casualties and diseases, than those in more open exposures; and those of a somewhat tender nature, as the fig and exotic grape, will flourish and fruit when thus protected, while in contiguous open localities they would be killed to the root every winter.

It has become a standard remark of late that many of our best fruit trees are more liable to disease, and their products more generally inferior, both as to quantity and quality, than they formerly were. Admitting as a fact that

much of this inferiority is owing to the increased age of orchards, as well as negligent culture, it cannot be denied that, even with improved knowledge in culture, many fruits are not produced in such perfection as formerly, under what would now be very properly termed unskilled labor.

Throughout most of the older cultivated regions of our country it is now of rare occurrence to find an orchard producing fruit not more or less imperfect. Apples are disfigured by warty and scab-like blotches, and pears are cracked and worthless. Blights, so called, are also more frequently met, and their origin as little understood as it was fifty years ago. We are fully aware of the prevailing tendency of some to applaud the past and decry the present. We can, also, give full allowance for the sympathetic associations of youthful times, when all seemed fair to our eyes, and when "stolen waters were sweet, and bread eaten in secret pleasant," and quarrel not with those who cannot see in our Bartletts and Belle Lucratives any such excellence as characterized the early Catharines of boyhood. Making due allowance for all this, we are still convinced that both diseases and destructive insects are on the increase, and that the time has arrived in all its fullness when cultivators must possess themselves of all attainable knowledge relative to the principles of vegetable growth, and endeavor to deduce from such knowledge a course of practice applicable to their locality and the various crops they cultivate.

When agricultural chemists first proposed to instruct us, and point the more practical operator to the proper mode of culture, high promises of valuable aid were given, and cultivators were induced to place confidence in the promises so lavishly bestowed. The conviction is, however, gradually becoming more settled that these promises are not being fulfilled. This was not unforeseen by intelligent, practical operators, as it was evident that the multifarious agents of vegetation, and their still further ramified combinations, could not be confined to the laboratory of the chemist; more particularly would the physical agents, air, light, heat, and moisture, be excluded from his investigations, or, at most, be but casually considered in his analytical labors. For example, in the analysis of a soil the chemist can very accurately determine the kind and amount of its ingredients, but he cannot so readily explain the exact specific relation that exists between these raw ingredients and their preparation as food for plants. He can bring to his aid the energetic and active properties of fire, acids, and alkalies, and is thus enabled to separate and value the substances of which the soil is composed; but this knowledge alone will not justify him in pronouncing upon the adaptability of that soil to produce a crop, for it has been repeatedly shown that a soil may possess an abundance of all the substances required by a crop, and yet be unproductive, for the reason that these elementary substances, although present, may not be in a sufficiently soluble condition to be available for the purposes of vegetation.

The constituent parts of a plant may, also, be very accurately determined; but how they are obtained, eliminated, held together, and assimilated by the plant, is another branch of study, as it is also the most important. Those who form theories and base their deductions upon investigations confined to the simple changes of *dead* matter will find so many opposing influences when life is concerned, as will compel them to a further study more intimately connected with vegetable physiology, and the important part that organic agencies exercise in the growth of plants, and the physical condition rather than the chemical constitution of the soil upon which they grow.

In the culture of plants the great aim should undoubtedly be to properly balance the agencies of growth; this is the great art of culture. Aware of the unlimited ramifications of this subject, it is not proposed to enter upon it at present, further than slightly glance at the importance of shelter as an auxiliary towards securing a desirable equilibrium of some of these agencies.

In brief, it may be stated that the necessities of shelter are two-fold—to guard against excessive aridity during summer and severe cold during winter.

In other words, to modify the debilitating effects of the injurious evaporation produced by the extremes of heat and cold.

The debilitating effect upon vegetation of continued aridity during summer is well known, and various expedients are resorted to, in order to ameliorate its influence, and it is found that one of the most effective, and at the same time most available means of checking evaporation is by arresting the currents by shelters of vegetation. Our natural forests are rapidly being destroyed, and it is admitted that the destruction of forests tends to lesson the moisture both of the atmosphere and the soil. The disappearance of the streams in the mountains of Greece, and the sultry atmosphere and droughts of the Cape de Verd islands, have been attributed to the destruction of forests. In densely wooded countries, where, in connexion with excessive rains, the climate is rendered unhealthy, clearing the lands of vegetation has been the means of vast improvement, as we are told has been experienced at Rio de Janeiro. Hence it is reasonable to suppose that by planting belts and groups, in masses, of hardy, suitable trees, in the vicinity of orchards and gardens, the dry currents will be arrested, and injurious exhalations from the crops measurably prevented; and, further, it may be found that atmospheric moisture will be increased by the proximity of such masses of trees from the results of condensation on their surfaces. That exhalation is much diminished when the drying current is arrested, and increased with the rapidity of the arid breeze, is well known, and the formula has been given that the same surface which, in a calm state of the air, would exhale one hundred parts of moisture, would yield one hundred and twenty-five in a moderate breeze, and one hundred and fifty in a high wind; the beneficial effects of arresting or diminishing the force of currents is, therefore, very evident.

So little are we acquainted with the diseases of plants, that no intelligent classification of them has been attempted. The terms *mildew* and *blight* are used in a general sense to indicate the results of disorganization; but the causes that produce these results are not so readily distinguished.

Mildew, in some one or other of its forms, has become one of the greatest evils connected with fruit culture. The mildew on the native and foreign grape, on the gooseberry, the cracking and scabbing of the pear and the apple, are well known causes of perplexity to cultivators; and, although the formation and increase of mildew is not particularly well understood, and while it is, perhaps, premature to advance the opinion that it is wholly the result of atmospheric disturbances, and capable of being prevented by suitable shelters, there is accumulating evidence showing that position and exposure are closely connected with its appearance and exemption.

For the successful adornment of lawns and pleasure grounds, shelter is of the first importance. One of the greatest obstacles to the growth of choice evergreen trees and shrubs, especially during the earlier stages of growth, is the aridity of our summers. Broad-leaved evergreens, as the Mahonia, the Rhododendron, and others of similar character, must be sheltered and protected if they are expected to grow into objects of beauty or interest. In their native habitat these plants are protected by superior vegetation, and surrounded with an atmosphere more uniformly charged with moisture than they usually are in artificial plantations.

Protection during winter is not less an object of utility. The degree of cold that plants will resist uninjured is a question that cannot be definitely answered; a plant will occasionally be destroyed by a degree of cold that it previously encountered without apparent injury. We are not to suppose, in cases of this kind, that they proceed from changes in the laws of nature, but rather that the resisting power, by some means or other, has been reduced, or, what is more probable, that the mere thermometric degree of cold is not the main cause of injury.

Future investigations may determine that many of the diseases of plants originate from the effects of cold and its accompaniments during winter. There

is no reason why fatal influences may not linger in vegetable as well as in animal organism, and our experience and observation has led to the conviction that such instances are by no means rare.

According to the theories of De Candolle, the power of plants to resist extremes of temperature is—

1. In the inverse ratio of the quantity of water which they contain.
2. In proportion to the viscidity of their fluids.
3. In the inverse ratio of the rapidity with which their fluids circulate.
4. In proportion to the size of the cells, so is the liability of plants to freeze.
5. The power of plants to resist the extremes of temperature is in exact proportion to the amount of confined air which the structure of the plants themselves enables them to contain.

Whatever degree of truth these theories may contain, there is not much calculated to materially assist the ordinary cultivator. He cannot ascertain the dimensions of the cells, neither can he measure the quantity, nor decide upon the quality of their fluids; external appearances will not contribute to his aid, for, while the oak and the orange are undeniably of solid texture, the one is hardy and the other is not; the wood of the fig is similar in texture to that of the willow; but while the first is susceptible of injury from slight frost, the willow will stand unharmed through our most severe winters.

The exact process by which cold destroys plants is a matter on which there is room for much conjecture. The mechanical action due to the expansion of fluids while freezing, in lacerating and disrupting their tissue and thereby destroying the connexion of the sap vessels, has been deemed a sufficient explanation. We cannot, however, consider it a conclusive reason for all the phenomena observed when plants are frozen. The disruption of tissue and fluid cells is a probable and reasonable cause of decay, and no doubt deaths are produced from this cause; but, as has already been remarked, plants may at times be subjected to a severity of cold that solidifies the sap, and yet remain perfect and healthy, while they will succumb to comparatively slight cold, if long continued and accompanied by rapidity in the currents of air.

When green-house or other tender plants are accidentally frozen, they may be resuscitated by carefully shading them from the sun, sprinkling them with water, and surrounding them with a moist atmosphere, continuing these conditions until the temperature is increased to a safe point. We have repeatedly tried the experiment of removing a plant thus frozen into a house, where it was placed under the influence of a dry heat and exposed to the sun while in the frozen state, and the experiment proved fatal to the plant. This mode of treating green-house plants, when accidentally exposed to a few degrees of frost, is a common and successful expedient. We have seen eight degrees of frost suddenly obtain in a green-house containing a varied collection of plants, many of them of a very tender nature, and so completely frozen that many of the branches and succulent shoots were rendered as brittle, and broke as easily as a delicate rod of glass; yet by prompt and effectual shading, and increasing the moisture and temperature slowly, very few were injured. It is difficult to conceive how plants so circumstanced could escape destruction if their tissue is disrupted when the sap which they contain is converted into ice, since no after treatment could then save them, as no process, either slow or rapid, could reconstruct the tissue.

Whatever may be the injury from disruption, we are convinced that extreme cold and extreme heat act in a similar manner upon plants, and that exhaustive evaporation is equally injurious, whether produced by one or other of these extremes; and although physiologists have not been able to give any well-defined explanation why one plant is hardier than another, further than that its constitution is adapted to its natural climate, it is well known that plants are rendered more capable of resisting extremes when their wood has attained its greatest degree of maturity. This also coincides with the opinion of De

Candolle; his first, second, and third axioms prove that plants resist frost in proportion to the solidity of their wood.

Perfect maturity of growth is the great object of all cultivation; this fact should always be uppermost in the mind of the fruit-grower. Too much importance cannot be placed on the fundamental principle, in fruit culture, that whatever tends to render tissue moist, increases its susceptibility to injury from cold, and whatever tends to reduce humidity, and hasten the conversion of fluid-matter into woody fibre, increases its power of resisting cold; but this is not the only result of thorough maturity, for without it there can be no fruit. The failures in fruit-culture arising from excessive luxuriance, and stimulated growths that never mature, are beyond calculation. The production of mere wood growth and the production of fruit are antagonistic processes; and until this fact is recognized and acted upon the highest excellence of culture will not be attained.

With regard to the hardihood of plants and the necessities of protection, there are individuals who maintain that a fruit tree or plant to be valuable, or fitted for general culture, must be able to take care of itself. This cannot be looked upon in any other light than as a lame excuse for indolence and neglect. It is the province of man to assist nature in producing such results as he finds most desirable for his purposes; and if he removes plants from their natural conditions, and then leaves them to take care of themselves, he must expect to realize the usual consequences of neglect.

The object of these remarks may be rendered more apparent by a brief enumeration of some of the more important advantages which may be expected from partial shelter and protection, and through them the exemption from, or modification of diseases of various kinds on some of the most valuable fruit trees and plants.

THE APPLE.

The cracking of the apple and the blotches and scarifications frequently observed on its surface have been referred to the attack of fungoid growths or mildew. Various examples have been cited where orchards, sheltered from prevailing winds, have shown a decided exemption from these attacks. In opposition to this supposed cause of immunity it has been asked, Are our orchards more exposed now than they formerly were? As a general rule, we think it quite likely that they are, seeing that in all sections as cultivation increases the forests are gradually thinned and cleared. The effects of destroying the forests of a country have already been noted; and we have a partial recognition of the importance of shelter in the precept of many intelligent orchardists who advocate the planting of fruit trees much closer than has formerly been the rule, and also in the practice of encouraging the trees to branch quite to the surface, instead of training to a clear stem five or six feet from the roots. Both these expedients have a tendency to prevent rapid circulation of air through the orchard, and consequently are so far a preventive against evaporation from the soil as well as from the surfaces of the trees. Examples are not yet sufficiently numerous to warrant a decided opinion; but so far as they have been noted, the prospect of greater immunity by this mode of treatment is encouraging.

THE PEAR.

The cracking of this fruit has given rise to much speculation, and various theories have been advanced with reference to the cause. For a long period the opinion prevailed that it was owing to a deficiency of certain mineral ingredients in the soil, and various remedies based on this assumption were freely dispensed and tried, but with indifferent success. It is not now doubted that it is the result of mildew, and that the atmosphere, and not the soil, is at fault. In support of the opinion that it is governed by atmospheric influences, the fact may be quoted that the White Doyenne, one of the finest pears when

perfect, rarely succeeds in exposed localities; yet, when grown in positions thoroughly protected, it is still produced in all its pristine beauty and excellence. Referring to cases with which we are familiar, we have seen annual exhibitions of this fruit grown in the built-up portions of the cities of Philadelphia and Baltimore, most perfect of its kind, without spot or blemish, when those from trees growing in the more exposed suburbs invariably proved defective. Again, it has been lately shown that, fruited in the quiet atmosphere of a fruit-house, they attain great perfection; and further, we have seen a tree, one of a row that produced worthless fruit, enclosed on all sides by a small box, open at top and elevated a few inches above the soil, produce perfect fruit, while the productions of the adjoining trees were, as usual, cracked and worthless. Whatever may be allowed for protection in the above cases, it is very evident that they were not influenced by the nature of the soil.

The origin of the blight on the pear tree has also been a fruitful source of conjecture. No doubt the term is applied to effects produced from various causes. We will state our observations on one species of this malady or disease. Those who have pear orchards will, perhaps, recall instances where the trees, or portions of them, have suddenly ceased to grow shortly after budding in spring. The young leaves and growths present a blackened appearance and rapidly wither. On examination, the bark will present a shrivelled appearance, and on cutting into the wood it is found discolored and apparently in a state of decomposition. In some instances a solitary limb, but more usually one side of the tree, will be more particularly affected. By cutting down until all discolored wood is removed, the plant will recover; but if neglected, the entire plant will be destroyed. Having lost many trees in this manner, and observing that it was most prevalent after severe winters, especially if the ground was frozen fourteen or sixteen inches during February and the early portion of March, it occurred to me that it was induced from evaporation at a time when the plants were unable to absorb by the roots. When the soil is frozen to a depth of sixteen inches it is evident that all roots within that depth must also be frozen, and absorption and circulation be completely arrested. While the roots are in this state the branches are subject to the drying air of spring, and their juices are exhausted by evaporation; the supply of moisture by the roots being inert, the plant has no more power of supporting life than it would have supposing it to be cut over at the surface and thrown on the ground. These conditions, long continued, must result in injury; and if not immediately destructive, disease is engendered, to be intensified by the first untoward influence.

It is not to be supposed that this is the sole cause of blights, but I am convinced that it is a frequent one, and more prevalent on what are termed dwarf pears, the roots of which being quince, do not reach so deep as the pear roots, but rather ramify and spread nearer the surface, and therefore are more likely to be included in the frozen strata. Supposing that this was a source of blight, I adopted the practice of covering over the roots in early winter with charcoal dust, a few inches in depth of which will entirely prevent the penetration of frost. Since this precaution has been adopted, I have not observed even a blighted limb or leaf. I think it cannot be shown that the roots of plants are in any degree benefited by being frozen, and it can certainly be shown that they are oftentimes injured by it. Therefore it is a safe rule to protect the roots so that their absorbing powers may constantly be ready for action.

It may be well to note, in connexion with this subject, that crops, both of apples and pears, are sometimes lost by late frosts when they are in bloom. It is an old custom, but now much neglected, to have ready, in various suitable localities around an orchard, several heaps of dried weeds or rubbish of such description; then should a slight frost occur when the trees are in bloom, set fire to these heaps and endeavor to create as much smoke as possible. Crops

have repeatedly been saved by this precaution. It is obvious that these smoking heaps should be placed on the windy side.

THE PEACH.

The curl, or leaf blister of the peach, although seldom fatal in its effects, checks the growth and diminishes the crop. From the circumstance that these blistered leaves form a famous asylum for the aphis, these pests of vegetation are generally found lurking in the blistered recesses which has given currency to the opinion that they are the sole cause of the evil. This, however, is not the case, as is evident from the fact that they are not always present on blistered leaves. It is entirely atmospheric, and may be looked for after sudden extreme fluctuations of temperature. Referring to my notes, I find that a change of 30° in 48 hours invariably produced it, but trees sheltered from the prevailing wind were mostly exempt. A notable instance is recorded in my journal of 1849. The thermometer fell 40° in twenty-four hours, with a cold northeast wind. Previous to this the peach trees in a small orchard planted on the east side of a close board fence were in perfect health; in less than one week afterward the leaves were severely blistered, and the sheltering influence of the fence was peculiarly prominent.

THE GRAPE.

It is well understood by intelligent grape-growers that atmospheric changes are the great cause of mildew on that fruit, notwithstanding that opposite opinions are persistently promulgated. We have taken the trouble to investigate some of these pretended immunities, and have been astonished at the perfect ignorance displayed with reference even to the appearance of mildew. We have visited a vineyard where the plants were almost totally denuded of their foliage from its effects, yet the proprietor was publicly announcing his system of culture as one that insured entire exemption from mildew and other diseases. We allude to this here for the purpose of showing that opinions can only be valuable when given by an intelligent and experienced observer.

The following extract from a late work will show the necessity and effects of sheltering vineyards:

"The fact that grape vines growing in sheltered positions, such as under the eaves of buildings and under the shelter of trees, are generally found exempt from this species of mildew, points us to the most available remedy; and the common occurrence of vines growing in trees, where they are sheltered by overhanging foliage, retaining their health, while branches from the same roots trained on an exposed trellis near by will be severely attacked by mildew, is very strong evidence that the cause is mainly atmospheric.

"Tracing the cause of mildew to this source, it becomes a matter of inquiry how far we can employ expedients that will either prevent or modify its effects. Undoubtedly shelter of some kind from sudden changes and atmospheric currents is one of the most prominent, and every experienced grape-grower can recall instances where even a seemingly slight protection proved of great value."

THE STRAWBERRY.

Most of our cultivated varieties of the strawberry will, on ordinarily well-drained soils, endure without winter protection. But it is a ruinous mistake to suppose that they are not benefited by it. The statement can be proved that, on an average of seasons, plants properly protected will produce one-third more fruit than those left exposed. The crop will also ripen earlier; the opinion of those who have the most experience, and who are most successful and cultivate with most profit, is uniformly in favor of winter protection. Shelter from the effects of wintry winds prevents exhaustion, for although the strawberry is a lowly plant, it is greatly affected by the rude breezes so frequently characteristic of our spring weather.

THE RASPBERRY.

To procure a perfectly hardy raspberry has long been one of the greatest efforts of fruit-growers. Perhaps we already possess as hardy a race as we

can expect. To have fruit of the best quality it is necessary to enrich the soil, and this stimulus tends to a luxuriant growth of cane which will not invariably attain that thorough rigidity of maturity necessary to withstand the winter and spring winds. But the finest varieties need not be excluded simply because they require protection. A crop may always be insured by bending down the canes and covering them lightly with soil. In tolerably sheltered grounds good crops are secured without such precautions, and it has long been observed that those growing on the south or east side of a fence are most uniformly productive.

No better mode of protecting roses, grapes, raspberries, &c., during winter, has ever been practiced than that of simply bending down the shoots and covering them with soil. Even when so as to be in close contact with the damp soil, without any covering, the benefit is very decided. They are thus not only placed below the rapid drying currents, but are enabled to absorb moisture by their surfaces to counteract evaporation.

As it might appear from the tenor of these remarks that an undue importance has been given to the destructive agencies of mildew, we append the following preliminary to a critical notice on fungi:

"Ignorant persons may wonder what interest can attach to such productions as fungi; they imagine them to be merely what are called toad stools; or, if they look a little further, their vision rests on a mushroom or a morel. When you talk of truffles, then, indeed, the lovers of good eating, many of whom never before heard that a truffle was a fungus, prick up their ears and begin to think there may be something in the study, but there they stop. Little dream they how large a part these productions perform in the economy of nature. Could they only understand the many forms and many properties attaching to such plants they would cease to regard them with contempt. That many are eatable and many poisonous is known to all men. What is not so well known is, that they are among the most deadly and insidious enemies of mankind. What devastated Ireland and led to the regeneration of that country but the potato fungus? What has ruined the vineyards of all the west of Europe and Africa but the vine fungus? What carries destruction into the galleries of silk-growers but the caterpillar fungus? What crumbles to dust our houses and shipping but the timber fungus? What seizes upon poor human nature in its greatest extremity but fever fungi? Our corn shrivels in the ear; its enemy is the corn fungus. It becomes a ball of filthy soot; the smut fungus is present. The grain that should ripen into nutritious food becomes a deadly poison; the ergot fungus brings on that mischief. Our living trees turn pale and perish standing; root fungi are their enemy. Our bottles, which once contained a generous beverage, gradually are the receptacles of a filamentous mucilage, and wine becomes a stale, spiritless fluid; the mother fungi are there. Infinite, indeed, is the evil they produce, and yet we owe our daily bread to their action; for the substance called yeast, to which belongs the singular property of setting up fermentation, is itself no more than a vast assemblage of living fungi, too minute to be seen by the naked eye. What a field there is here for observation and reflection! What friends to encourage and what enemies to destroy! What food to collect and what waste of food to avert!"

To provide the necessary shelter, recourse must be had to artificial plantations of hardy trees, and of these evergreens will form the most effectual protection, and should mainly be depended upon. Of all evergreens, the Norway fir will prove most serviceable, and a single row of them planted six feet apart will, in a few years, form a sheltering wall of dense foliage. This tree naturally grows very symmetrical; but if any of the side branches outgrow their neighbors, they should be trimmed in to a proper distance. The lowest branches should always be widest. A little timely care will always insure this.

When large areas or open level plains, as on the western prairies, a single row should not be deemed sufficient. Belts not less than forty feet in breadth should be planted. The most effective points to plant are those from west round by north to east. A variety of trees may be used in these belts. The white pine is a fast-growing tree, and can be kept thick and compact by cutting the points of those shoots that tend to over luxuriance. The Austrian pine is a tree of dense, robust habit, very hardy, and, like the Scotch pine, will adapt itself to any dry soil of good depth. The balsam fir will thrive better in lowlands than any other evergreen, and, although it may not be the most ornamental of trees, it is well fitted for massive planting. The hemlock

spruce, most beautiful of all evergreens, should not be overlooked. It will thrive well as undergrowth, and form a graceful boundary fringe to thickets.

In vineyards and pear orchards, more particularly the former, great advantage would be derived from secondary hedges running in parallel lines, say two hundred feet apart. These may be formed of the American arborvitæ, our best evergreen hedge plant. In pear and other orchards, Norway fir may be used for a like purpose.

To secure an effectual shelter the plants must be thickly set; and even when the plantation is intended to be ultimately evergreen, a liberal mixture of rapidly-growing deciduous trees should be introduced. Fast-growing trees, as the silver maple, English alder, various willows, balsam, and cottonwood poplars, the European larch, and others, will be most suitable. The young evergreens will be greatly benefited by the shade of the deciduous trees, but the latter should be pruned and gradually thinned as the evergreens increase, and removed altogether when the object of their introduction has been accomplished.

We close for the present these desultory remarks upon a subject that will, ere many years elapse, demand and receive popular attention. They might have been more specifically enlarged had the object in writing them, not been rather to draw the attention of fruit-growers to the diseases of plants than to impart particular advice relative to details.

WILD FLOWERS.

BY THOMAS GARDNER.

TREES, shrubbery, and flowers: all know how to distinguish them, and all know their value and importance in the adornment of homes of taste, and in the numberless ways in which they minister to the pleasures and comforts of life.

This chapter treats only of flowers—wild flowers—flowers which every American may meet in some part of the United States, and which, by their beauty, would probably attract the attention of the most indifferent to floral charms.

"Wild flower" has not the same significance in our country that it has in most others. In that, for instance, from which we derive our language—England—native flowers and wild flowers have much the same meaning, very few being cultivated, except such as are imported from other countries, or, as we would say, "exotics."

Her territory embracing no greater area than some of our medium-sized States, the most showy of the wild flowers become well known to the inhabitants, and thus seem too common for cultivation.

Our wild flowers do not seem common to us; our country is too large for this idea. The beautiful flowers of Texas or Arkansas are as really exotics to the inhabitants of Maine as the Fuchsia of Peru or the Victoria Regia of Brazil; yet to a citizen of the United States they are "native plants"—wild flowers—of his country. In a certain sense all flowers are *wild flowers*. When we speak of domestic animals as distinguished from wild animals, we understand a species of changed nature which they assume by the taming process.

The transfer of a wild rabbit to a cage would not cover our idea of domestication; though confined for a long term of years, it would be but a "wild" rabbit still. So most of the beautiful flowers that adorn our greenhouses and gardens are still but wild flowers that have been culled from the broad field of nature's covering. Yet some flowers do undergo this taming process, and, as in the case of domestic animals when under skilful care and intelligent management, change their wild nature and assume forms and characters unknown to them in a wild state. The Pansy, the Geranium, Fuchsia, Carnation, Rose, amongst many others, are instances of this changed character, most of them, in a wild state, being very insignificant weeds, or, at most, not particularly attractive wild flowers. Also, as in animals, there are many that cannot be tamed, so amongst flowers; but very few can be brought thus to change their nature by any skill thus far brought to bear on them. The sweet Mignionette, well known to all for its delicious fragrance, is yet the same, in every respect, as those growing wild in the south of Europe, though it has been under culture for many generations; it is, in reality, the same wild flower.

The difference in the meaning of this term "wild," as relatively applied to plants or animals, is pointed out because great numbers suppose a cultivated plant to be an improved wild flower; and it is often expressed, as a matter of astonishment, that such or such a wild flower is not cultivated, "as it is quite as handsome as any in the gardens." This difference is also pointed out to show that some wild flowers can be "domesticated" in the sense in which animals are; and it is hoped that those who have not hitherto been much attracted to our wild flowers, and who, on a perusal of these pages, may be induced to take an interest in them, perhaps may notice in some one flower a disposition to vary that has not yet been known to show this character, and thus a new race of cultivated plants be added to our collections.

These flowers that have been found to vary and become improved by cultivation are called "florist's flowers." They are thus called because they owe their variations to the skill of florists, and not to the ordinary processes of nature. Some of our wild flowers have already been brought into this condition. The perennial Phlox is one of this class. There is about a dozen of different wild species growing in different parts of the United States from Canada to Florida, along river banks or in swamps or wet places.

The French and Belgians, having noticed in them a tendency to vary, have applied to them their "florist's" skill, and have now many hundreds of different forms, many of them of great beauty, and all from twelve originals, so mean and uninviting in appearance that probably not one in a hundred of those who read these papers ever knew a wild Phlox, or had his attention in any way called to it, common everywhere though wild Phloxes be. Our Mountain Laurels (*Rhododendrons*) afford another instance. We have but four wild species—one of these, a little insignificant plant, growing on New England mountains, and another, a small bush, small-flowered, growing in Georgia. The other two are known, one as the northern Mountain Laurel, (*Rhododendron maximum;*) the other as the Catawba Rose, (*Rhododendron Catawbiense.*)

From these two, English cultivators have raised hundreds of most beautiful and magnificent varieties, which are at once the pride and glory of English gardens.

They give a name to a class of plants which they distinguish particularly as "American plants," mostly composed of these improved Rhododendrons, and poor, indeed, is that garden considered which has not a portion laid off as the "American ground."

We will now turn to our "herbarium"—a collection of dried specimens of the plants of the United States east of the Mississippi, and point out to the friends who will go with us through the examination those wild flowers that are particularly worthy of attention for their beauty or for some peculiar

attractiveness. The first collection comprises the *Ranunculus*, or butter-cup family, which embraces many very pretty varieties.

The snow is scarcely gone ere the *Hepatica* is in flower in the woods through the whole, except a few of the most southern, of the United States. It has small, three-lobed leaves of a thick texture, from which it takes its name of "Liverwort"—*wort* being an old Saxon name for "plant." There are red, white, and blue varieties, wild; and cultivation has produced double varieties of all these colors; then the "wind flowers," or *Anemones*—low-growing plants, which are well known by their leaves being borne on a single stem, and the single flower again arising, as it were, out of the nest of leaves. There are many pretty species: one, the "Pasque flower," (*A. Nuttalliana*,) a large blue flower, is common in Illinois. The Carolina wind flower (*A. Caroliniana*) has a large, sweet-scented, rosy, white flower. The wood wind flower (*A. nemorosa*) is the pretty white one, seen everywhere in spring, and the Rue-leaved wind flower, (*A. thalictroides*,) growing with and much resembling the last. The Larkspur (*Delphinium*) belongs to this same "butter-cup" family. We have four beautiful kinds, all with tallish stems, of blue flowers—one, the large blue, (*D. azureum*,) growing in Wisconsin and southward; another, the tall Larkspur, (*D. exaltatum*,) from the middle States southwest; the greenish white of North Carolina, (*D. virescens*,) and the three-spurred (*D. tricorne*) of Pennsylvania and Ohio.

The Black Snake root (*cimicifuga*) is also a very pretty plant of this family. There are also *Aconites*, several species with blue flowers, resembling monks' hoods; the yellow marsh Marigolds (*Calthas*) of the swamps; Columbines, of which one (*Aquilegia Canadensis*) with crimson and yellow blossoms, growing among rocks, is one of the prettiest of the spring-blooming flowers; the *Clematis* and Ranunculus, or true "butter-cups;" all these embrace the most ornamental plants of the family. The family of Berberries has some interesting individuals. Unlike some other natural divisions of the vegetable kingdom, they have little striking resemblance to one another. The May apple, for instance, belongs to this class, as does the red berried plant well known as Berberry. One of these plants is interesting, from having been named by a botanist in honor of President Jefferson, (*Jeffersonia diphylla*.) It is commonly known as the "twin leaf," has something of the appearance of the May apple, but not quite so coarse, and grows in the middle and southwestern States. In a systematic arrangement of plants several orders of aquatics come next. The yellow Pond Lily of the northern States is well known. In the streams of New Jersey and States north of it the white Water Lily attracts by its odor and beauty during July and August. This is the *Nymphæa odorata* of botanists, or sweet-scented nymph, and is, by far, the most interesting of our wild flowers amongst aquatics.

Further south they increase in beauty. The *Victoria Regia*, of Brazil, is world renowned. Its flowers have measured twenty-two inches across, and the leaves six feet in diameter, when under cultivation in greenhouses in the north, and are often larger in its native river. The yellow Nelumbo (*Nelumbium luteum*) is an attractive curiosity, not so much for beauty as for the interest attached to it as the only American representative of the sacred *Lotus* of the Egyptians.

The pitcher plant family (*Sarracenias*) are very curious swamp plants; what would be the leaf stalks in other plants are in this swollen out, so as to form large hollow pitcher-like vessels. The flowers in shape are somewhat like the yellow Pond Lily, not so large or showy. The purple one (*S. purpurea*) is the only northern species; the others, of various shades of yellow and purple, extend through the swamps of the Atlantic States to Florida. The poppy family mostly belongs to Asia, but very few representatives being found in our country. The Bloodroot or Puccoon, (*Sanguinaria Canadensis*,) however, is very common over the whole of the United States. There is but one other

true poppywort really indigenous to this country, and this is not very showy. It is a low-growing, yellow-flowering, perennial plant, of western woods, known to botanists as *Meconopsis diphylla.*

The class of fumitories has one genus in which almost all its members are pretty. This is the *Dicentra,* commonly known as "Dutchman's Breeches," from a resemblance in the flower to some antique pattern of pantaloons. They are all northern plants; one white, (*D. cucullaria,*) one purple, (*D. formosa,*) and one white and purple, flowers very pretty, (*D. bulbosa.*) There is a pretty climbing plant, known in cultivation as the Alleghany vine. This is the *Adlumia cirrhosa,* and, though not common, is found on rocky hills in most parts of the Union.

The next tribe of plants to be noticed is a very large one—the cabbage tribe, or cruciferous, as it is most generally known. This is a very natural looking class; all the flowers consist of only four petals, arranged in the form of a cross, whence the name "cruciferous." The wall flower, stock gilly, turnip, mustard, and candy tuft are some common things that we may name as serving to identify the class to the common observer. Though there are some seventy species, natives of the United States, very few are handsome enough to warrant notice here. Most of them are very common weeds; one of them (*Draba verna*) is the first flower to bloom in spring. It is a very small plant, with white flowers, and is abundant everywhere before the frost is fully away in spring.

The Violet family is the next in our arrangement that has anything of much interest, and these are well known. Most of the European kinds are sweet-scented. Ours have not this advantage, but are more showy. There are eighteen species among our "wild flowers," nearly all of interest. The pansy of our gardens belongs to this family. Indeed, it is of this genus, a true viola—*V. tricolor.* The St. John's Worts contain a few pretty things, mostly, however, insignificant weeds. *Hypericum pyramidatum,* or pyramidal St. John's Wort, has large, yellow flowers, and grows on dry hills, generally, in the middle States. There are some of these shrubby, as *H. prolificum, H. areum,* and *H. Kalmianium,* which, for their beauty, are often kept in gardens.

The Pink family includes such plants as Carnations, Pinks, and Sweet Williams, which most of us know and love so well. Most of our wild kinds are, however, very insignificant weeds. Some few are beautiful. *Silene virginica,* for instance, has bright scarlet flowers. It grows in the middle States, extending southward. A white species (*S. stettata,*) with fringed white flowers and leaves in fours up the stem, is common everywhere in July, and is a very elegant plant. With two or three other rare species, very seldom seen even by botanists, the whole list of beauties in the Pink Worts is exhausted.

There are a few pretty things in the Purslane family. The *Claytonia* is the best. This has fleshy leaves—generally only two—long and narrow, and has a few white pink-veined flowers, seemingly springing from these leaves. In April and May these Claytonias are abundant everywhere. They go by the name of "Spring Beauty."

The Mallow family has a few showy branches. The Althea or "Rose of Sharon" is well known. In the swamps, near large rivers, the surface is beautiful in August with the yellow flowers of the *Hibiscus palustris,* or American "Jute." The Okra of our gardens belongs to this family, and is the *Hibiscus esculentus.* The cotton is also of the Mallow tribe, known to botanists as *Gossypium herbaceum.*

There are a few pretty plants in the Geranium family; only one, however, "*G. maculatum,*" would attract much attention. This is common in woods in early summer. The Wood Sorrels have but one pretty plant. This is the *Oxalis violacea,* and, though an humble plant, is very pretty indeed.

But the prettiest tribe of plants, to an American observer, is the butterfly-flowering, *papilionaceous* or *leguminous.* Like the cabbage-flowered tribe it is

very natural, and its members are easily distinguished from other classes The Yellow Acacia is known as "Golden Prairie Flower" in Arkansas, (*A. lutea.*) The Yellow Cassia, a nearly allied plant, growing near all northern river banks, is known also as Wild Senna. The Yellow Baptisia is known everywhere as Wild Indigo. There are also many pretty peas, vetches, saintfoin, and clover, growing everywhere. The *Tephrosia Virginica* is particularly handsome, and there is scarcely an insignificant plant in the whole family.

The Rose family is well known, but as they are mostly trees and shrubs they are without the limits we have marked out for this paper. There is one very pretty herbaceous plant, not to be forgotten, however. This is the Indian Physic, (*Gillenia trifoliata.*) This grows in rocky woods from New England to South Carolina; grows about eighteen inches high, and bears a profusion of pinkish white flowers.

The *Melastoma* tribe is the showiest of any family of plants, but they are mostly tropical, and to be seen only in our greenhouses. The *Rhexias*, or, as our people call them, "Meadow Beauties," comprise the only native genus; we have eight species, and all pretty as their foreign congeners. They grow mostly in wet meadows.

In the family of Evening Primroses the *Œnothera* is well known. They are nearly all yellow or white. In the Saxifrage family the *Mitella diphylla* is a delicate and very pretty plant. The flowers are small, pure white, and fringed around the edges. It grows abundantly in the woods of the northern and middle States. Of the Saxifrages proper, one is very common early in spring, growing everywhere, over dry rocks, and making the whole surface white with bloom. This is the *S. virginiensis,* or Early Saxifrage. The Umbelliferous family is a very numerous one. To this the carrot, parsnip, parsley, and celery belong. Yet in going through our herbarium we cannot note one that we can say is "a pretty wild flower." We were near passing over the Madderwort family with its "cleavers," and "bedstraws," and "wadders"—useful enough in the arts and sciences, but of little application to our subject. But we must not forget the little Partridge Berry, (*Mitchella repens.*) Its red berries peeping through the snow, with its shining green leaves in winter, and very sweet white flowers in spring, make it well known. Again, the "Bluets," "Innocence," "Dwarf Pink," with, perhaps, some other common name, is one of the prettiest ornaments of our spring meadows. This is the *Houstonia cœrulia* of botanists.

The next family to be noticed is the composite. This has, by far, the largest list of flowering plants of any in the Union, but they all have a great sameness. The Dandelion, Thistle, Aster, Golden Rod, or Sunflower, will give a good idea of the general character of this family. They are most common in the fall, and are usually yellow or white; occasionally blue, pink, or purple. There are very few of the beautiful varieties that are scarce, and as they are so showy and common as to attract general attention, we need not particularly point them out here.

In the order of Lobelias are several pretty varieties. The Cardinal Flower, (*Lobelia cardinalis,*) a scarlet flower growing in swamps and blooming late in the fall, may be considered, perhaps, the most showy of our wild flowers. A blue one (*L. siphylitica*) grows with it and is also beautiful. Then there are a few smaller flowering kinds, and blooming earlier; *L. spicata,* for instance, that all will think pretty.

In Alpine countries the Bell flowers are numerous and showy. America has few of them. Two, *Campanula Americana* and *C. rotundifolia,* are the prettiest we have. These are confined to the northern States. The Primrose family is also a family having numerous handsome representatives in some countries. But we have but one that it is worth while saying much about, and that is the American cowslip, (*Dodecatheon media.*) This is a native of the western States, and is a beautiful plant indeed.

We have now come to another order of plants that is very extensive, and contains a greater variety and more distinct types of beauty than any other American order. This is the Figworts, (*Scrophularias.*) There are about thirty *genera* of American plants, and in nearly every genus there are some handsome plants. To give an idea of what plants compose this order, the Snap-Dragon may be named, the Mimulus or Monkey Flower, the Fox Glove, and the Mullein. The Mullein (*Verbascum*) has one very pretty species, the Moth Mullein or *V. Blattania.* There are white, purple, and yellow varieties. Probably it is not truly indigenous, but originally introduced from Europe. Another introduced plant, and very common, is the Yellow Toad-Flax, (*Linaria vulgaris,*) one of the prettiest as well as one of the most troublesome weeds to the farmer. The Turtle-Head (*Chelone*) is a very pretty wild flower, growing along streams. One of them, with white flowers, shaped like the back of a tortoise, (*C. glabra,*) is common in the northern States, and the other with purple flowers (*C. Lyonii*) is a southern plant. The *Pentstemon*, or "Bearded Tongue," is another pretty tribe, extending from Canada to Brazil. The most common northern one is *P. pubescens*, a lilac and white flower, and very pretty. *P. dissectum*, with curiously cut leaves, grows in North Carolina. One of the prettiest is *P. grandiflorus*, growing principally west toward the Rocky mountains. *P. digitalis* is an Ohio plant, with an abundance of fine white flowers. Of the "Monkey Flowers" a pretty blue species, growing on stems two feet high, grows in most wet places in the Union, flowering in the fall. This is *M. Vingens.* The well known musk plant is a Mimulus, but comes from the Pacific coast. The *Veronica* is a very pretty genus. There are some fourteen wild kinds, but mostly introduced from Europe. Three of the real Americans are worth knowing. *V. Virginica*, a popular medical plant, known as "Culver's Physic." This has close spikes of bluish-white flowers, and grows up nearly two feet. It has not the usual "Speedwell" look of the other Veronicas. *V. spicata*, the Blue-Spiked Speedwell, and *V. gentianoides*, the Gentian-Leaved Speedwell, are very pretty, low-growing kinds, with blue flowers. We have no true Fox Gloves indigenous, but *Gerardia* is a good substitute. Our people call these plants "Yellow Fox Glove." Most of them are yellow. *G. flava*, *G. quercifolia*, and *G. pedicularia*, grow all over the Union; *G. pectinata* and *G. integrifolia* are scarce. They have all large, yellow flowers. Another section of *Gerardia* are low of growth and mostly purple flowers. The *G. purpurea* covers whole fields in the fall with its pretty purple flowers; there are eight or ten others, nearly allied and nearly as pretty, scattered over the Union. The "Painted Cup," well known to children for its bright flowers, growing in wet swamps and flowering in June, is the *Castilleja coccinea.* We said flowers, but in reality it is the painted bracts or leaves surrounding the flower which are so prettily colored. One species, smaller than this, grows west; and another, prettier but yet smaller, is a northern Alpine plant. The "Louseworts" (*Pedicularis*) are pretty. There are but two, *P. Canadensis* and *P. lanceolata*, common on most waste ground. The *Labiate* or lipped-flowered plants are as numerous as the figworts, but do not present so great a variety in form and color. Blue is the prevailing tint. They are easily distinguished from Figworts, which they much resemble at times, by their having always four naked seeds in their seed vessels, while Figworts have many small seeds in an enclosing capsule. The Sage, Lavender, Pennyroyal, and most of these square-stemmed, aromatic herbs will give a good idea of all the plants of this order.

The "Blue Curls," (*Trichostemma dichotoma,*) growing about six inches high, abounds in most grain fields, blooming in August. *Ceranthera linearifolia* is a pretty southern plant; of Salvias, or Sages, *S. azurea*, blue, and *S. coccinea* are two handsome southern kinds, and *S. lyrata*, a blue one, is common north and worth noticing. The "Mountain Mints," or "Bergamots," (*Monarda,*) are all pretty. *M. didyma*, with scarlet flowers, is a very fine variety.

The *Scuttellariæ*, or "skull-caps," so called from a little cap-like covering falling over the naked seed after flowering, are all more or less handsome. There are also eleven wild species. *Macbridea pulchra* is a pretty swamp plant of Georgia. *Synandra grandiflora* is a beautiful plant of Ohio. *Physostegia Virginiana*, or *Dracocephalum*, is one of the prettiest of wild flowers.

The flowers stay where they are turned, as if hung on a swivel. There are some handsome varieties amongst *Stachys*, but they are mostly coarse. Amongst the Borageworts are some genera of pretty flowering kinds. This family of plants is easily distinguished by its spikes of flowers being coiled backwards. The Heliotrope and "Forget-me-not" will give the idea. Only one genus of American plants is handsome—Mertewsia, or the "Lungwort." There are three species—*M. Virginica, M. maritima*, and *M. paniculata*—growing mostly in the northern States. The family of "Water Leafworts" (*Hydrophyllacea*) is altogether a pretty one. The *Nemophyla Cosmanthus, Hydrolea*, and *Thacelia* of our gardens are all our "wild flowers;" and the true *Hydrophyllums—H. Virginicum, H. Canadense*, and *H. macrophyllum*—deserve to be as highly prized. The *Phlox* family (*Polemoniacea*) has been before alluded to. Besides the true *Phloxes*, the "Greek Valerian," (*Polemonium reptans*,) with blue flowers, is one of the prettiest spring ornaments of our stream banks. The *Convolvulus* family is so well known as "Morning Glory" that nothing more need be said than that those seeking pretty wild flowers will be sure not to overlook them. The *Solanum* family includes the Jamestown weed—*Stramonium*—pretty enough if it were not so very common. The potato, tomato, egg plant, ground cherry, capsicum pepper, tobacco, and other well known things, all belong to this family, so that it is at least useful, if not as ornamental as others. The *Gentian* family has many very pretty representatives. The *Sabbattia* and *Erythræa*, or American Centaureas, fifteen species at least, are all pretty; the true *Gentians*, mostly blooming just before frost with various shades of blue, and all pretty also. The Milkweed family (*Asclepiadaceæ*) is a class of plants remarkable for the peculiarity of the structure as well as the beauty of the flowers of most of them. The common milkweed or wild cotton is well known by the cottony down that envelopes the seed, as in the true cotton. It wants, however, the barbulate property which gives the cohering power to the true cotton, and is therefore useless for any similar economic purpose. The most common kind is the *Asclepias cornuti*. The handsomest kind is the "Butterfly Weed," (*A. tuberosa*.) This has bright, orange-colored flowers that are universally admired. *A. variegata* is a beautiful white, with rather large flowers, and a less coarse growth than some of the others. *A. nivea* is still prettier, but is rather rare, even south, where it seems most at home. Of the purple varieties, *A. purpurascens* is the purple milkweed, so showy in almost every piece of uncultivated, wet ground in the fall. The *A. rubra* grows in very wet bogs, and is also a pretty purple. The *A. Michauxii* is a Georgia species, not very pretty, but very fragrant. These are the best, but all the milk weeds, about twenty species, are more or less attractive.

We now come to a part of the herbarium which embraces plants that are mostly trees and shrubs, such as oaks, willows, poplars, that are not within our scope just now, or docks, sorrels, or spinages, that have no beauty or interest to our subject until we reach the curious *Orchid* family. This consists of those curious flowers that often look more like butterflies, bees, or other insects, than real, living flowers. They are so uncertain in their appearance, and seem to have so little affection for the cultivator of the soil, that we know of few so well known that we can refer to one and say this may be taken as the type of the family. Perhaps the "*Ladies' Tresses*" is the most common kind. This is the white-flowered plant, common in meadows in the fall, that has its flowers arranged, like the thread of an auger, spirally along its dark green stem. Bota-

nists call it *Spiranthes tortilis.* It may give some kind of an idea of what an orchid is like, but affords none of the rare beauty possessed by most kinds. The "Ladies' Slipper," or *Cypripedium,* is perhaps the handsomest genus of orchideæ, but they are rather scarce. There are about fifty species, natives of the Union, any one of which will attract the attention of the student in search of beautiful wild flowers; of the bulbous-rooted plants, or plants of allied sections, we have many very pretty ones. In the Amaryllis family is the Atamasco lily of North Carolina, bearing pretty, rosy, purple cups. The Star-grass *(Hypoxis)* has yellow, star-like flowers, and is common in northern woods early in spring. Of the Iris, or Flower-de-Luce family, we have to name several interesting kinds. The *Iris Virginica* is quite as pretty as the Persian Iris, of which thousands are annually imported from abroad. It is of a beautiful blue. The most common blue flag, however, is the *I. versicolor;* this is a coarser and more water-loving plant than the Virginian. Another very pretty one is the Six-angled Iris of Georgia, of which we see blue, yellow, and white varieties. The Copper Iris (*I. cuprea*) is also a Georgian, and one of the best of the family. There are also two small growing kinds, but quite attractive—one, *I. cristata,* grows in pine barrens in North Carolina; and the other, *I. vernata,* flowers very early, and is a beautiful object on the Kentucky and Tennessee hills. The Blue Eye or Bermuda grass (*Sisyrinchium*) is a very common plant in every damp meadow; an allied, but much prettier, thing is the *Nemastylis gemmiflora* of Missouri and the west, with flowers four times the size, but as dark a blue as the common Bermuda grass. The Lily family is one of renowned beauty, and America has as pretty representatives as any country in the world, though the Japan species seem to have more fragrance and greater size. We have four true lilies, (*Liliums*)—*L. Canadense* grows in wet places all over the Union; *L. superbum* is common north, but does not extend far below Mason and Dixon's line; the *L. Philadelphicum* extends north to Canada, while the *L. Catesbei,* a very beautiful plant, is the only one common south. The "Dog-tooth Violet," (*Erythronium,*) with yellow drooping flowers and spoon-shaped leaves, so common in damp woods and meadows in spring, belongs also to the lily family. There is a white variety, but quite uncommon. The Quamash or Western Squill, (*Camassia esculenta,*) with large, onion-like roots, is a pretty flowering western plant. The "Star of Bethlehem" (*Ornithogalum*) whitens every spring meadow. A yellow species (*O. croceum*) is a native of Georgia.

We have now passed in review about all the handsome wild flowers of the United States. The object has been to call attention to them, and to say just so much about them as would direct towards them that spirit of inquiry that may lead to a better acquaintance. To point out each with precision, so that any one could be identified by the description above, would have necessitated the employment of technical terms, which it has been our study to avoid. It is our wish to see our pretty wild flowers popular, and this could be done only by treating an account of them in a popular manner. Works on American wild plants, of course, include all wild species, and the majority of these interest only the purely scientific student. Our work has been to separate the wheat from the chaff, for the benefit of those who desire only the grain of beauty. To the ladies of the United States, particularly, we commend our task. On them, more than on the sterner sex, devolves all those little arts that render a tasteful home loveable and lovely. Plants and flowers enter largely into these delicate arrangements; and if our chapter shall, in any degree, aid in selecting for our wild plants the posts of honor awarded hitherto to foreign introductions, certainly no handsomer than they, we shall feel like the poet, who—

> "Having garlanded his native flowers,
> Cast the wreath at Beauty's feet,
> Who smiled—and that was his reward."

DESCRIPTIONS OF LEADING POPULAR VARIETIES OF THE APPLE AND PEAR.

The descriptions here given are only of those varieties that have received the largest number of votes in the American and other pomological conventions as being worthy of general cultivation, and to which are added a few of the most promising varieties of recent introduction and less extended dissemination. These descriptions are but an appendix to an article the writer had prepared, giving minute detailed instructions for the growth, culture, and pruning of the pear, apple, and grape, from the seed to the orchard, vineyard, or garden, but which was thought to occupy, at this time, undue space, as compared with the interests of other subjects.

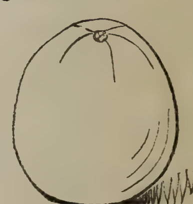
Hon. Marshall P. Wilder, of Boston, and Messrs. Ellwanger & Barry, of Rochester, New York, two of the most extensive and best fruit-growers in this country, are entitled to thanks for samples of fruits, from which the accompanying drawings have been made.

Some varieties of fruits, although of acknowledged excellence, have not been fully tested in all the States or sections of States, and hence, while individuals hold them in high esteem, they have not received as many votes in convention as other sorts that have been longer and more widely distributed. With pears it may be safely conceded that wherever a variety will ripen *perfectly*, its quality will be fully up to the standard here given. The change of climate from south to north, and *vice versa*, affects the quality of the apple more than it does the pear. The pear does not appear to lose its character by increase of its size and southern locality of growth as much as the apple; nor does it become any more sugary than when grown north and well *ripened*. The period of maturity or ripeness is hastened by heat, and hence varieties that in Massachusetts ripen in October, will, when grown in Georgia, be in eating condition the last of August.

The following figures of forms illustrating the terms used in describing apples are such as are generally acknowledged by all pomologists:

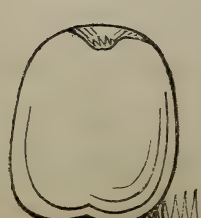
CONICAL.

ROUND.

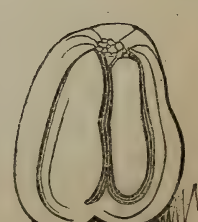


OVATE.

FLAT.



OBLONG



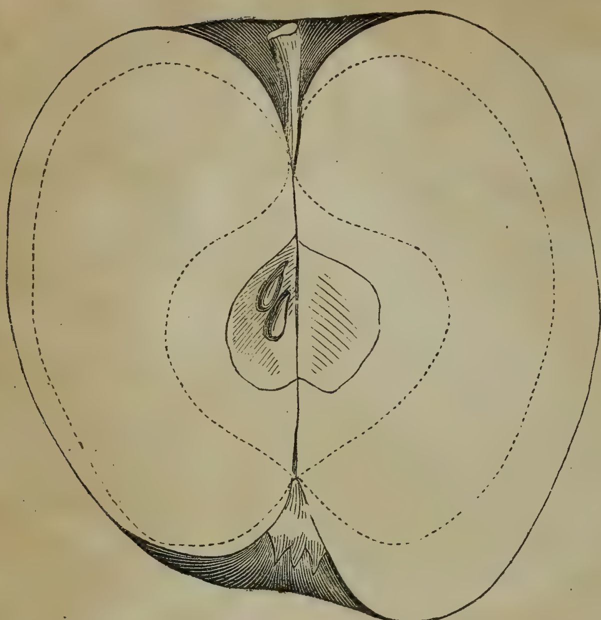
RIBBED.

The period of ripening, attached to each description of fruit, is for the middle section of the States.

DESCRIPTIONS OF APPLES.

American Summer Pearmain.—(Plate 2.)

WATKINS EARLY—EARLY SUMMER PEARMAIN.



Fruit.—*Size,* medium or above; *form,* roundish oblong, sometimes angular; the form and size are varied according as they are grown on top or bottom limbs, or in good or poor soil; *color,* reddish streaked, and blended with a grayish yellow, sometimes slightly russeted around the stalk; *stem,* medium, projecting about even with the surface; *cavity,* narrow; *calyx,* open, erect segments slightly recurved; *basin,* deep, round, smooth; *flesh,* tender, sub-acid, "best;" *core,* small; *seeds,* ovate, pyriform; *season,* August and September. *Young wood,* dull brown, covered with a few white spots; *leaves,* ovate acuminate; *flowers,* middle size. This variety should be in every collection, except such as are made up exclusively for market purposes. It is a hardy tree, with numerous small branches or twigs, and produces its fruit mostly on the ends of the branches. A deep, strong soil suits it best.

Benoni.—(Plate 3.)

Fruit.—*Size,* medium; *form,* roundish, narrowing towards the calyx; *color,* yellow, nearly covered with red, striped with darker shades, and with scattered whitish specks; *stem,* short, slender; *cavity,* narrow and deep; *calyx,* large, partially open; *basin,* deep, open, furrowed; *flesh,* yellow, crisp, tender, juicy, vinous; *core,* medium size, compact; *seeds,* pale brown; *season,* August and September. *Young wood,* dull reddish, with round russet specks, short jointed; *leaves,* medium size, oblong oval, point at apex, wavy, deep green, serrated; *flowers,* medium size. The trees of the Benoni apple are very erect, handsome growers, come early to maturity, and are very productive. It succeeds well in rich, strong soils, and is a profitable orchard variety.

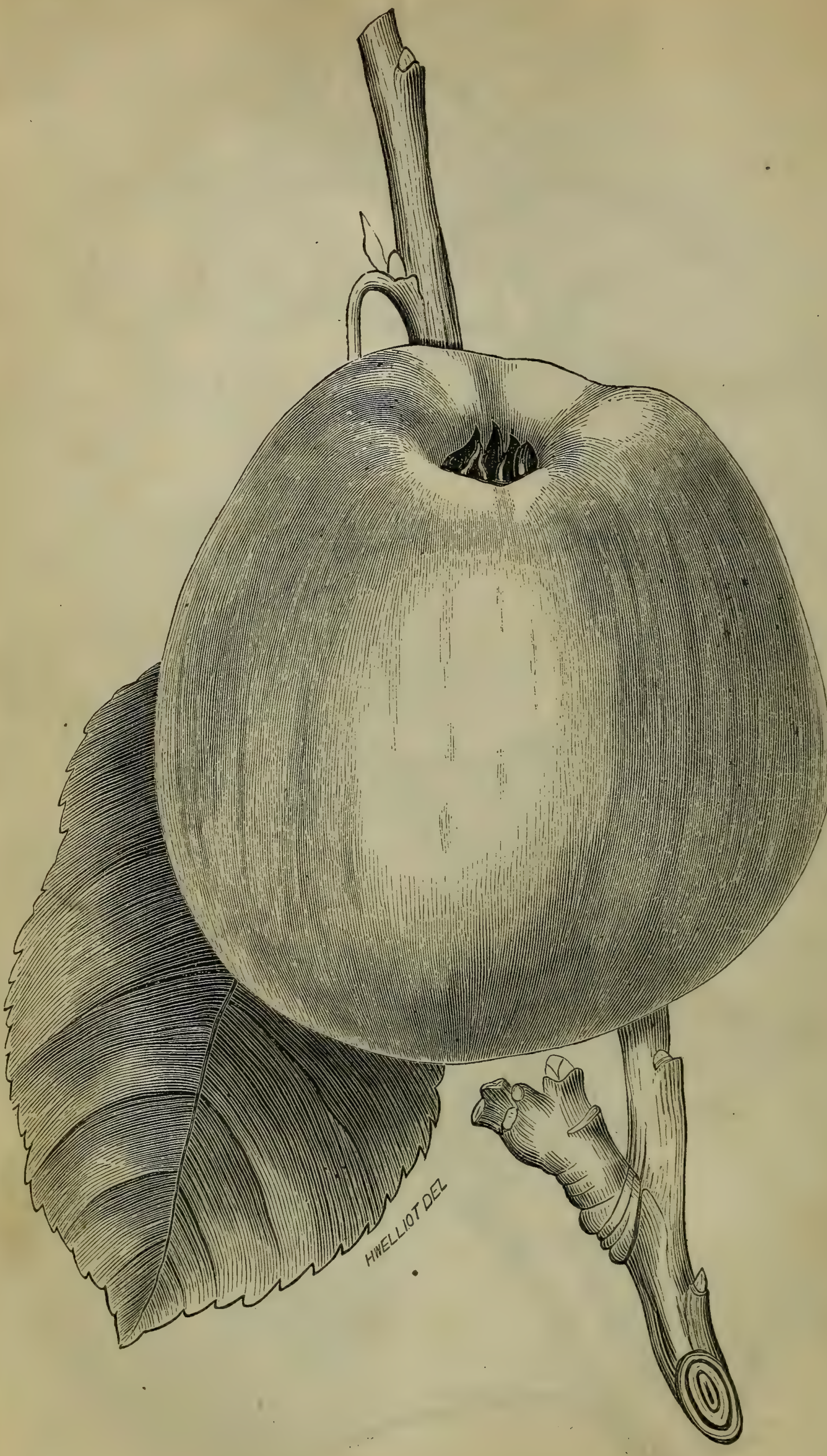
Baldwin.—(Plate 4.)

PECKER—STEELE'S RED WINTER.

Fruit.—*Size,* medium to large; *form,* roundish, narrowing a little toward the calyx; *color,* yellowish, nearly covered and striped with red, and dotted with a few russet spots, and with radiating streaks of russet about the stem; *stem,* about three-fourths of an inch long, slender, slightly curved; *cavity,* regular, deep; *calyx,* closed; *basin,* deep, narrow, plaited or furrowed; *flesh,* yellowish white, crisp, tender, sub-acid; *core,* below medium, compact; *capsules,*

1. Lady Apple. 2. Red Astrachan. 3. Seckel.
4. Delaware Grape. 5. Rebecca Grape.

Plate II.



AMERICAN SUMMER PEARMAIN.

PLATE III.

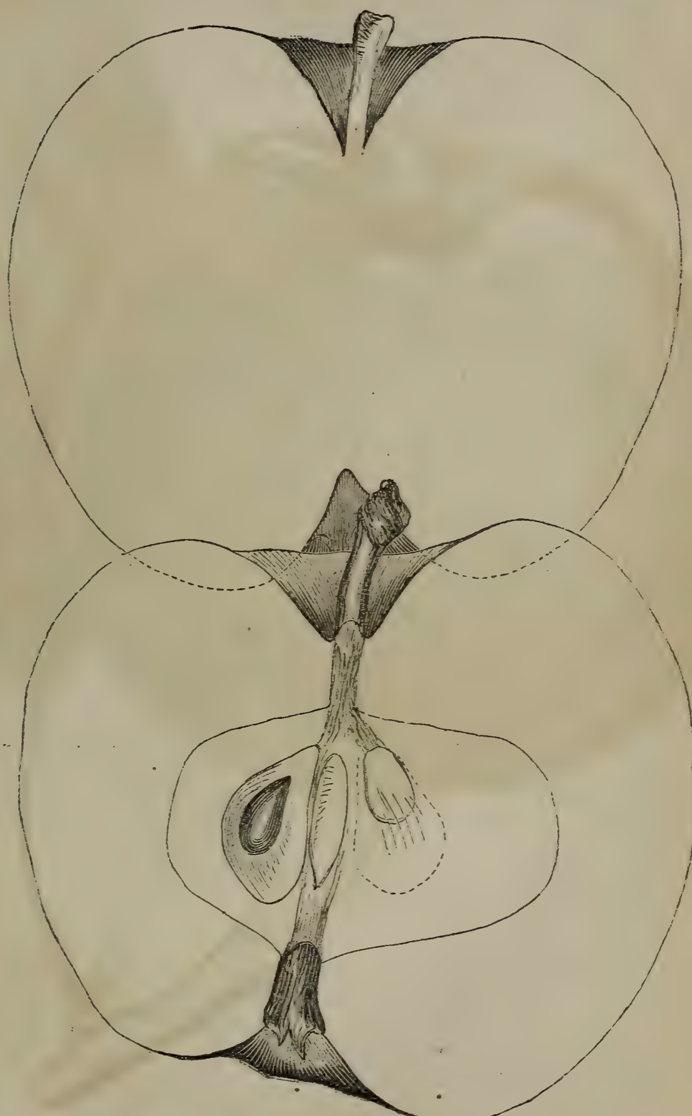
BENONI.

PLATE IV.

BALDWIN.

partially hollow; *seeds,* ovate, pyriform; *season,* early winter, but keeps well. *Wood,* reddish, stout, slightly downy, long jointed, and sprinkled with round white specks; *leaves,* large, thick, roundish ovate, wavy; *flowers,* large.

The trees of the Baldwin apple are very vigorous, with regular, erect, round heads; very productive, and, in strong soils with more or less of lime, &c., in them, produce very even, perfect, and uniform-sized fruit. The trees come



early to maturity. As a profitable market variety it stands among the very first. It originated in Massachusetts.

Early Harvest.—(Plate 12.)

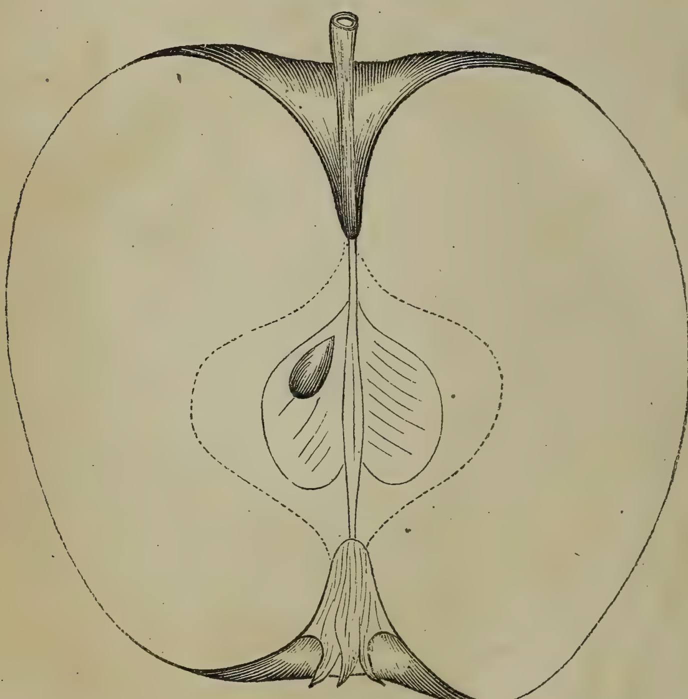
PRINCE'S HARVEST—EARLY FRENCH REINETTE—LARGE WHITE JUNEATING—JULY PIPPIN—YELLOW JUNEATING.

Fruit.—*Size,* medium; *form,* roundish, occasionally a little flattened at base; *color,* pale yellow, or straw color, faint tinge of blush in the sun, a trace of russet around the stem, and occasional spots of smooth russet, and some

white specks; *stem,* about three-quarters inch long, rather slender, sometimes short and stout; *cavity,* open, deep, regular; *calyx,* medium, closed; *segments,* narrow; *basin,* shallow, slightly furrowed; *flesh,* white, tender, juicy, crisp, sprightly, sub-acid; *core,* medium; *seeds,* abundant, light brown, ovate; *season,* early July. *Wood,* reddish brown, small white specks, short jointed; *leaves,* medium, roundish, obovate, tapering to a point, somewhat wavy, light green; *flowers,* medium size. The trees of Early Harvest are rather slow growers, upright, healthy, early, and abundant bearers. In strong, limestone clay soils its fruit is large and fine, and it is a very popular dessert apple wherever grown; but its skin is so delicate, and it shows a bruise so quickly, that it is not profitable for the market orchard.

Fall Pippin.

PHILADELPHIA PIPPIN.



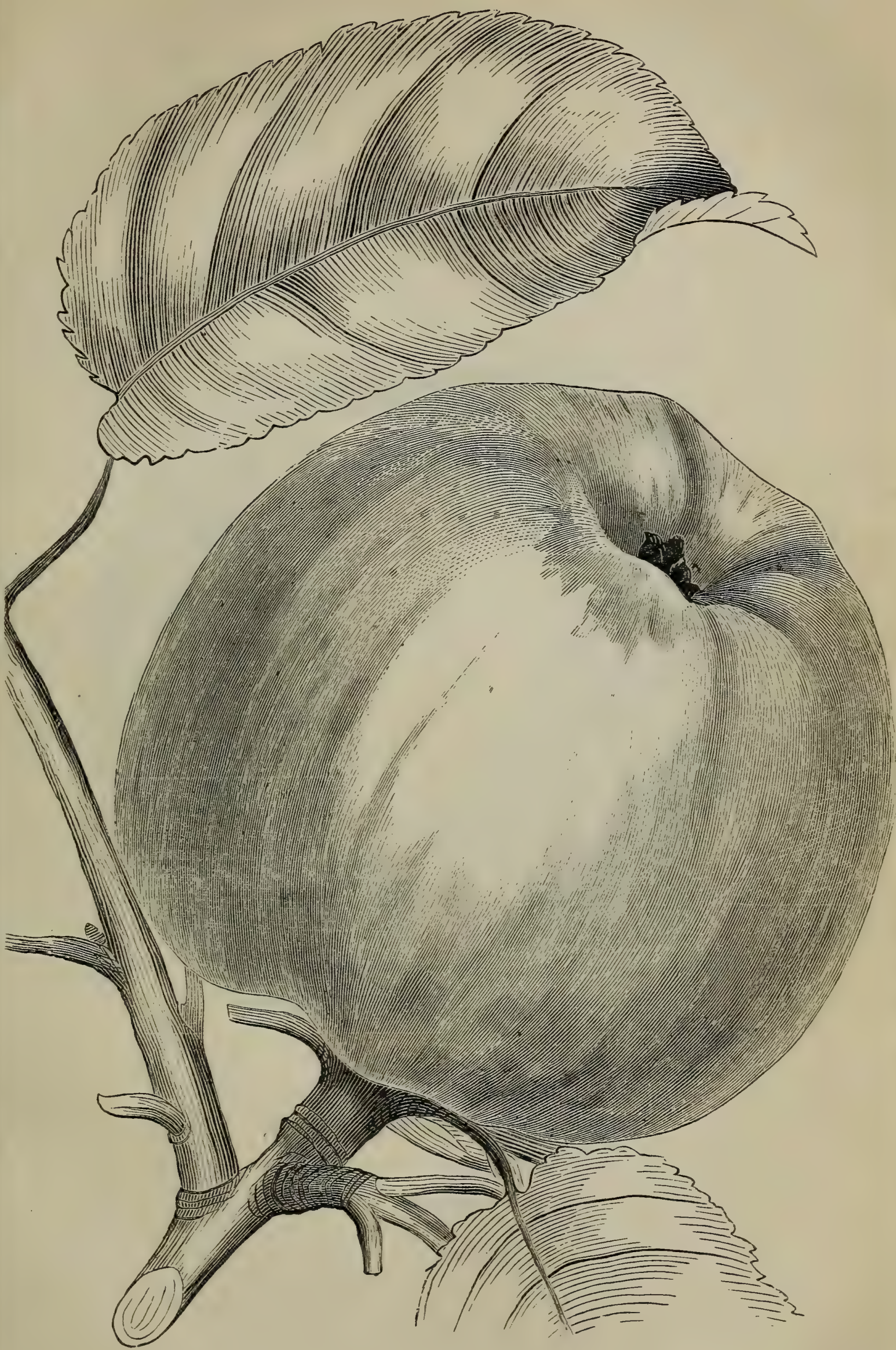
Fruit.—*Size,* large; *form,* roundish conical, flattened at ends; *color,* greenish yellow, until fully ripe, then rich yellow, with a faint blush when grown in good soil and well exposed to the sun; *stem,* long, moderately stout; *cavity,* deep, round; *calyx,* above medium, with segments in divisions; *basin,* deep, wide, and open; *flesh,* yellowish white, tender, juicy, sub-acid, aromatic; *core,* medium; *seeds,* ovate; *season,* October to December. *Wood,* dark; *leaves,* roundish ovate, broad. In strong clay loams the fall pippin is one of the best of apples, proving hardy and a good moderate bearer; but in black alluvial soils it is often tender and unprofitable.

Fall Wine.

SWEET WINE—OHIO WINE—SHARPE'S SPICE—UNCLE SAM'S BEST.

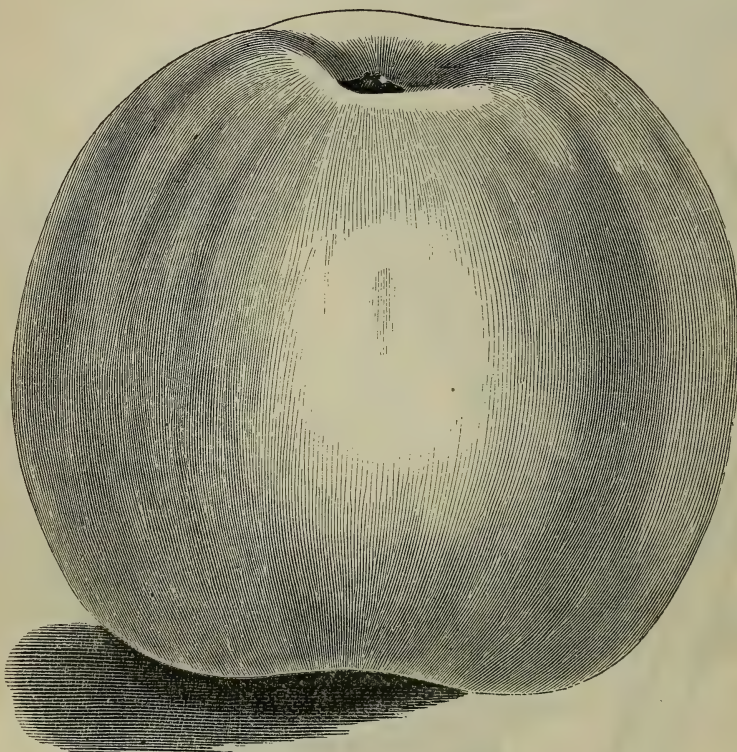
Fruit.—*Size,* medium to large; *form,* roundish, flattened; *color,* rich red, marbled over clear yellow, with many spots or specks of a brownish red, sometimes it is faintly striped; *stem,* slender; *cavity,* deep; *calyx,* half closed; *basin,*

Plate V.



GRAVENSTEIN.

PLATE VI.



HUBBARDSTON NONSUCH.

open, shallow; *flesh,* yellowish, crisp, tender, juicy, rich, sub-acid, vinous; *core,* small; *season,* September to November. The trees of the Fall Wine are of a slender, fine-grained, hard wood, healthy and hardy, annually and moderately productive. For very rich soils the trees are well adapted, but the fruit is too delicate to bear long shipments. As a dessert sort it is very superior. Not much grown in New England.

Golden Sweeting.

ORANGE SWEET.

Fruit.—*Size,* medium to large; *form,* roundish, rather deeper than wide; *color,* yellow or green, suffused slightly underneath the skin, and with many small greenish dots that become russety in the sun; *stem,* medium to long; *cavity,* round, regular; *calyx,* closed; *basin,* round, moderately deep, slightly furrowed or crimped at base of calyx; *flesh,* yellowish white, very rich, sweet; *core,* medium, round, regular; *seeds,* abundant; *season,* July and August. The Golden Sweeting is extremely valuable as a baking apple or for stock feeding. It is a regular bearer of more than average crops; hardy, and, forming a low tree of only moderate size, is well suited to bleak locations or as a shelter for more delicate sorts.

Gravenstein.—(Plate 5.)

Fruit.—*Size,* large; *form,* roundish, flattened, a little irregular, somewhat ribbed, surface undulating; *color,* at first pale greenish yellow ground, becoming a rich yellow, beautifully striped and splashed with bright red; exposed, or grown mostly in the sun, the red prevails, and becomes of a beautiful dark hue, with a few faint light green dots; *stem,* short; *cavity,* open, deep; *calyx,* with open, half reflexed segments; *basin,* rather deep, irregular, ribbed; *flesh,* yellowish, crisp, tender, sub-acid, with a peculiar aromatic taste; *core,* large; *capsules,* open, hollow; *seeds,* ovate pyriform, reddish brown; *season,* August to October. *Wood,* brown, purplish red, very strong; *leaves,* large, ovate, broad, glossy green; *flowers,* large. The Gravenstein is a variety almost indispensable in any and all collections. The trees are regular, strong, spreading, upright growers, succeeding, so far as yet known, in almost all soils, strong, rich loams producing the best fruits. It bears young, and annually, and is valuable either for kitchen, dessert or market purposes.

Hubbardston Nonsuch.—(Plate 6.)

Fruit.—*Size,* large; *form,* roundish conical, largest at the middle; *surface,* smooth, glossy; *color,* rich yellow, nearly covered with deep, warm red, and indistinctly striped with a lighter shade, almost crimson; russeted around the base of the stem, and sparsely dotted on the surface with large russet specks; *stem,* medium length, rather slender; *cavity,* broad, regular; *calyx,* large, partially open; segments, broad, short; *basin,* open, generally ribbed or furrowed; *flesh,* yellowish, crisp, tender, sub-acid, well flavored; *core,* small, compact; *seeds,* full, medium size; *season,* October to February. *Wood,* brownish chestnut, with whitish specks; annual shoots slender, downy at ends; *leaves,* large, ovate, oblong, thick, deep green above and a whitish down beneath; *flowers,* medium size. The trees of this variety are very regular, uniform, upright, moderately spreading; more hardy than the Baldwin when grown in very rich, strong soils. As a variety for ordinary family uses it is excellent.

Keswick Codlin.

Fruit.—*Size,* medium to large; *form,* roundish ovate, conical; *color,* greenish yellow, becoming light, clear yellow, and with a brownish blush cheek in the sun,

light dots, and one or two raised lines from stem to calyx; *stem,* slender; *cavity,* shallow; *calyx,* closed; *basin,* obscurely furrowed; *flesh,* greenish or yellowish white, tender, acid; *core,* medium; *seeds,* ovate; *season,* August to October. Tree spreading, upright, hardy, and very productive. As a cooking apple, and a tolerable eating apple when fully ripe, the Keswick Codlin takes, at this time, a leading position for locations where the ground is very rich, and where quantity of fair handsome fruit is more to be desired than a high standard of quality. It bears very young; is well known and much grown in Illinois and the west, but not in New England.

Lady Apple.—(Plate 1.)

API—PETIT API—POMME DE API—POMME ROSE—PETIT API ROUGE—GROS API ROUGE—POMME D'API ROUGE.

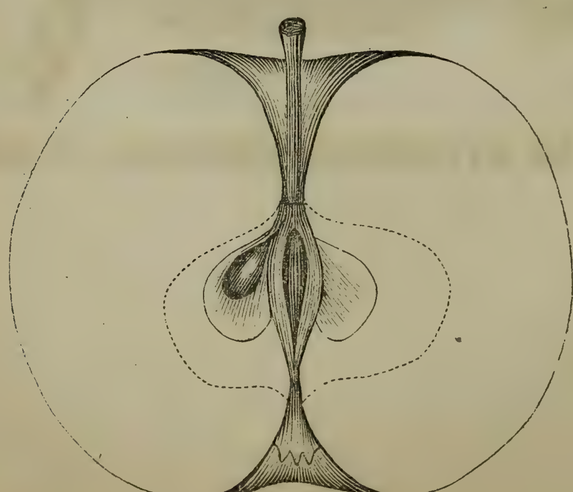
Fruit.—*Size,* small; *form,* flat; *color,* brilliant, clear red on light clear yellow, very glossy; *stem,* short; *cavity,* deep; *calyx,* small; *basin,* furrowed; *flesh,* white, crisp, tender, juicy, sub-acid; *core,* small; *season,* December to May. *Wood,* dark reddish; *branches,* very erect; *leaves,* small. The trees of the Lady Apple are slow, regular, upright growers, very hardy, forming beautiful pyramidal shapes. As a dessert fruit this apple commands the highest price. The trees are not early bearers, but when once they commence bearing are very productive.

Maiden's Blush.

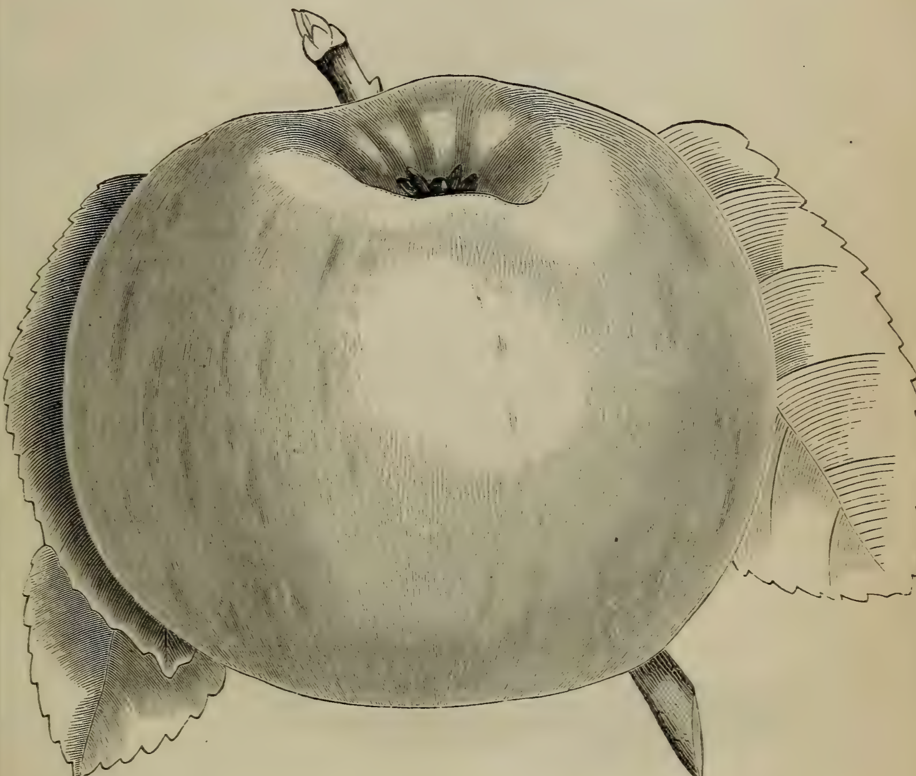
Fruit.—*Size,* medium to large; *form,* roundish, flattened; *color,* clear lemon yellow, with red cheek, varying from a faint blush to a rich crimson; *stem,* short; *calyx,* closed; *basin,* medium; *flesh,* white, fine grained, tender, sprightly, rather sharp sub-acid, unless fully ripened; *season,* September and October. The tree of Maiden's Blush forms a fine, round, spreading head, very productive; fruit handsome, and esteemed for cooking or drying.

Newtown Spitzenberg.—Vandevere of New York—(Plate 7.)

OX EYE—BURLINGTON SPITZENBERG—KOUNTZ—JOE BERRY.

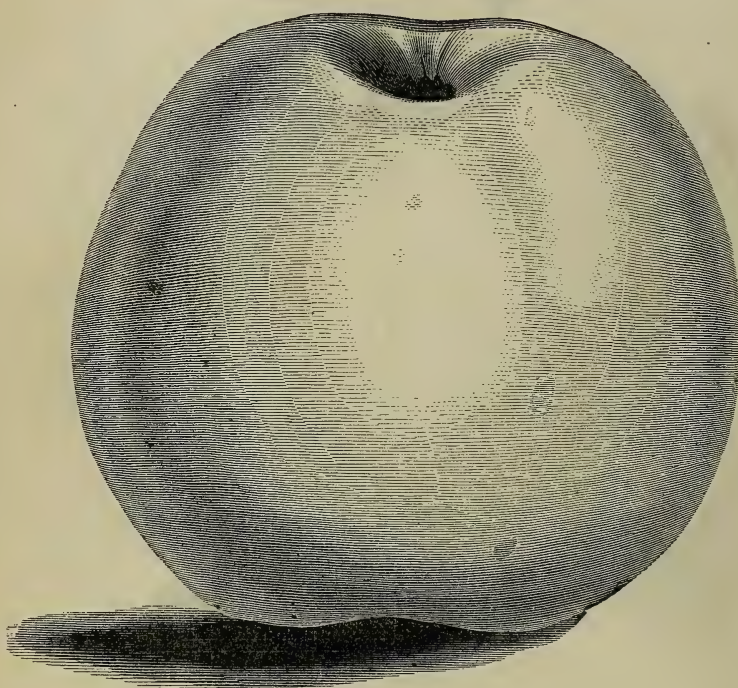


Fruit.—*Size,* medium; *form,* round, flattened; *color,* yellow ground, mostly striped and splashed with red, which often has the appearance of being cov-



NEWTON SPITZENBERG.—VANDEVERE OF NEW YORK.

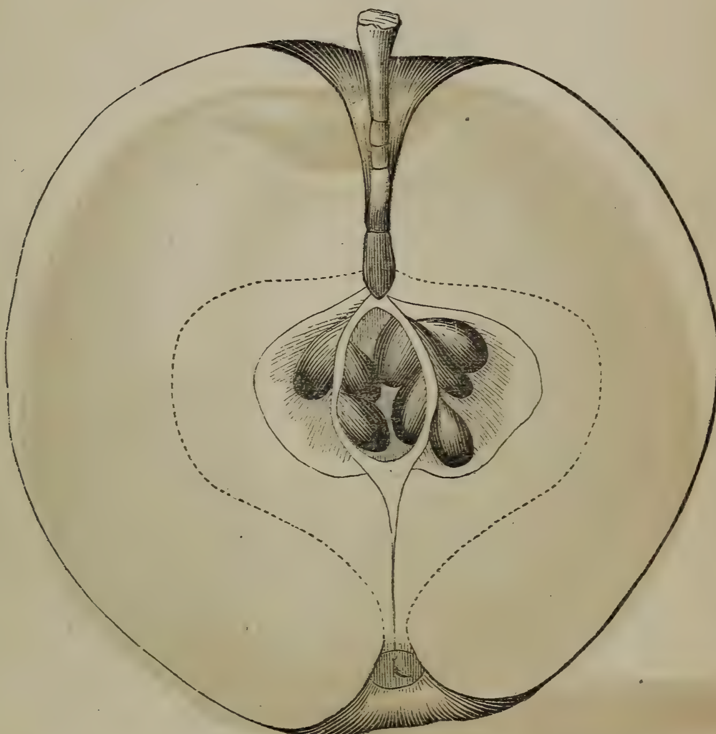
PLATE VIII.



PECK'S PLEASANT.

ered with a bloom; russet dots and lines that near the calyx, look like the crests of waves; *stem,* long, slender; *cavity,* small, segments erect; *basin,* open, regular, not deep; *flesh,* yellow, tender, very mild sub-acid, rich aromatic; *core,* small; *seeds,* few, ovate, pointed; *season,* December to February. *Wood,* dark brown, with a grayish tinge and with whitish spots; *leaves,* large, ovate, serrated; *flowers,* medium. A very hardy tree; good bearer; fruit of superior quality; keeps and bears transportation well.

Northern Spy.—(Plate 12.)

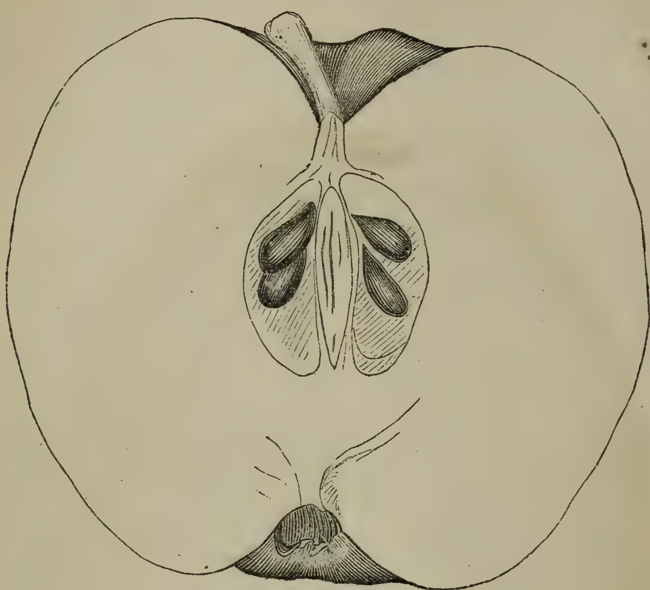


Fruit.—*Size,* large; *form,* roundish conical, sometimes ribbed; *color,* clear, smooth, pale yellow, mostly covered with glossy red, and with distinct stripes of almost purplish crimson, occasionally russet around the stem; when first gathered, covered with a fine bloom; *stem,* slender, projecting about even with the surface; *cavity,* open, wide, and deep; *calyx,* small, closed; *basin,* open, regular, other than the furrows produced by the ribs of the fruit; not deep, but rather abrupt; *flesh,* yellowish white, very tender, crisp, juicy, sprightly, sub-acid; *core,* large; *capsules* open; *seeds,* abundant, many of them triangular, ovate, pointed; *season,* December to March. *Wood,* dark reddish, with prominent round, grayish specks; *leaves,* ovate, oblong, wavy margins; *flowers,* medium. The tree forms a very handsome, upright head, requiring pretty severe pruning and thinning out, until it comes into bearing, after which it requires little or no pruning. The flowers of this variety open late in spring, and thus sometimes escape late spring frosts. It does not come early into bearing, but once in bearing it is very productive, while its keeping and eating qualities rank among the first.

Peck's Pleasant.—(Plate 8.)

WALTZ APPLE.

Fruit.—*Size,* medium to large; *form,* roundish, slightly (sometimes very much) flattened, with an indistinct furrow on one side; *color,* when first gathered, green, with a little dark red; when well ripened, a beautiful clear yellow,

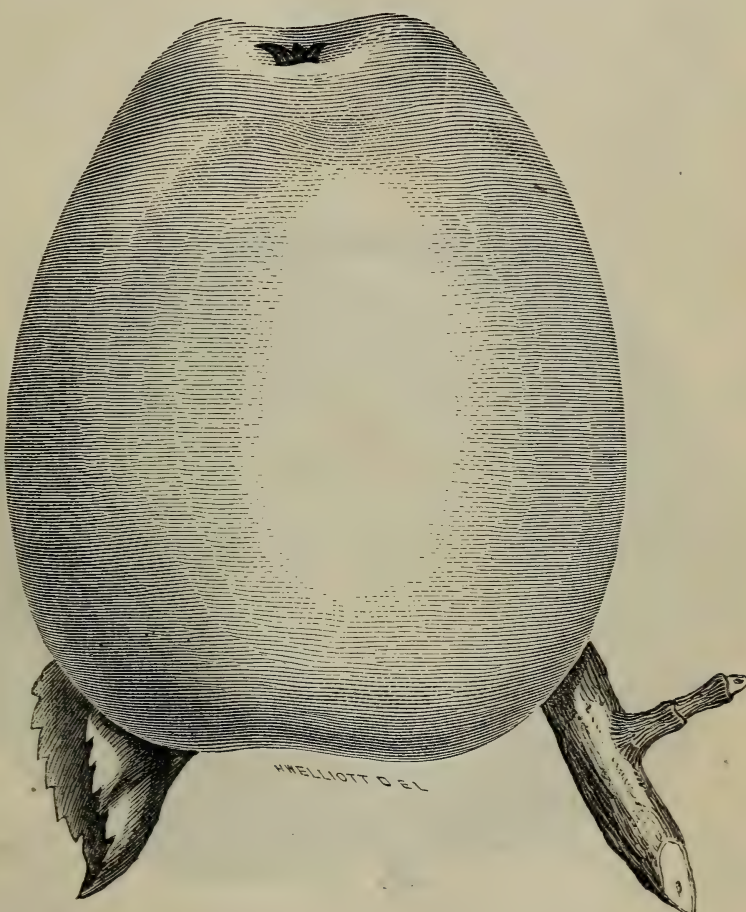


with bright blush on the sunny side, marked with scattered grey dots, that become small and almost indistinct near the apex; *stem,* varying, mostly short and fleshy; *cavity,* open, and almost always with a knob, ridge, or wave; sometimes russety on one side; *calyx,* medium, usually with the segments partially or half open; *basin,* pretty deep, round, regular, sometimes slightly furrowed; *flesh,* yellowish white, fine grained, firm, yet tender, juicy, mild, aromatic, sub-acid; *core,* medium; *seeds,* abundant, ovate, dark reddish brown; *season,* December to April. The tree is a moderate grower, of erect, slightly diverging form; when mature giving a good round head; hardy; comes early into bearing, and is very productive.

Porter.—(Plate 9.)

Fruit.—*Size,* medium to large; *form,* oblong conical, sometimes ribbed near the crown; *color,* bright, clear yellow, with a blush cheek in sun, often marked with spots of crimson red; *stem,* medium, rather slender; *cavity,* shallow, open; *calyx,* medium, partially open, with long segments reflexed at ends; *flesh,* yellowish white, fine grained, crisp, tender, juicy, sharp, sub-acid; *core,* medium size, partially open; *seeds,* large, acute, pointed; *season,* September and October. *Wood,* bright chestnut red, dotted with white specks, slender; *leaves,* large, oblong, partially folded; *flowers,* medium. The Porter apple makes a moderate sized, very regular, round-headed tree, comes early into bearing and produces a handsome fruit, good for table or kitchen use.

Plate IX.



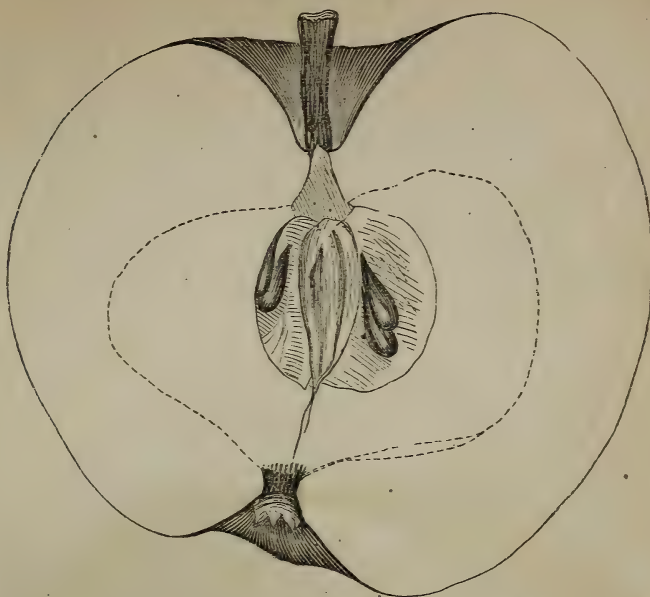
PORTER.

PLATE X.

KING OF TOMPKINS COUNTY.

KING OF TOMPKINS COUNTY.—(Plate 10.)

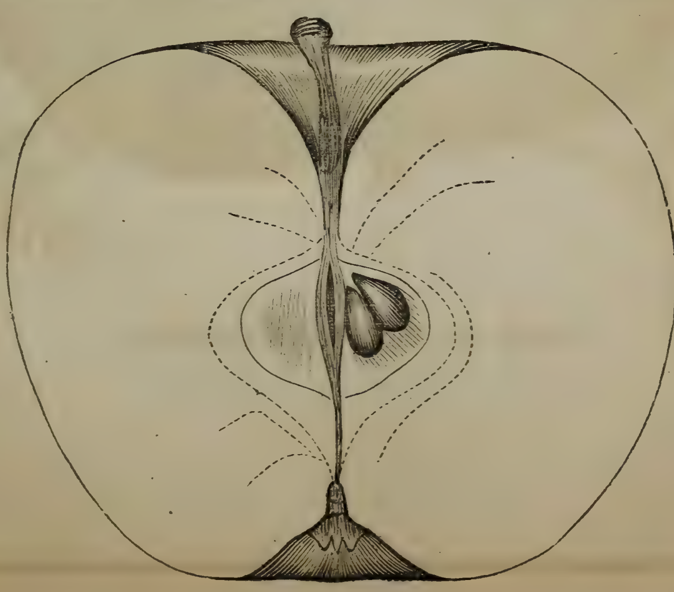
WINTER KING.



FRUIT.—*Size*, large; *form*, roundish oblong, somewhat ribbed; *color*, pale yellow ground, mostly covered with two shades of red, striped and splashed, brown dots and russet patches on the sunny side; *stem*, rather stout; *cavity*, open, regular; *calyx*, with long-pointed segments; *basin*, abrupt, slight furrows and projecting ribs surrounding; *flesh*, yellowish, crisp, juicy, tender, sub-acid; *core*, medium; *seeds*, abundant; *season*, December to March. The trees are of a vigorous, upright, spreading habit, annually productive of fruit of the highest excellence either for dessert or market purposes.

RAULE'S JANET.

RAULE'S GENNETTING—WINTER GENNETTING—JENNETTE—RAULE'S JANETTE—NEVER-FAIL—ROCK RIMMON—YELLOW JANETTE—INDIANA JENNETTING—KENTUCKY JANETTE.



Fruit.—*Size,* medium to large; *form,* roundish, conical, flattened at the stem end; *skin,* thick, tough; *color,* a ground of light, pale yellowish green, mostly overspread, striped and stained with dull red and with a blue or grayish shade, lying within, as of a bloom, small russet dots that show most when the fruit is high colored, sometimes patches of mould or fungus; *stem,* slender, rather long; *cavity,* deep, regular; *calyx,* nearly closed, with short segments; *basin,* open, regular, not deep, sometimes slightly furrowed near the calyx; *flesh,* yellowish, tender, mild, sub-acid; *core,* medium; *seeds,* angular, ovate; *season,* winter. This variety is only suited for middle southern sections, as Kentucky, Missouri, &c., because of its wanting a long season to mature perfectly. It blooms late in spring, and hence is an almost certain bearer. The trees have a spreading, open habit, are very productive, and the fruit, in good soil, is far above medium quality, keeping and bearing unusually well.

Rambo.

(IN NEW JERSEY, ROMANITE, SEEK-NO-FURTHER AND BREAD AND CHEESE APPLE)—TERRY'S RED STREAK.

Fruit.—*Size,* medium; *form,* flat or roundish flattened, sometimes ribbed or angular; *color,* yellowish white, marbled, and streaked with yellow and red, and with large rough spots; *stem,* long, slender, often curved; *cavity,* acuminate; *calyx,* nearly closed; *basin,* broad, slightly furrowed; *flesh,* mild, juicy, sprightly, sub-acid, aromatic; *core,* above medium, hollow in centre; *seeds,* abundant, ovate, pyriform; *season,* early winter. The Rambo has reddish brown wood, narrow, ovate, light-colored leaves, and makes a healthy, large, spreading tree, bearing annually crops of even, regular-formed fruit, in almost all soils and sections of our country.

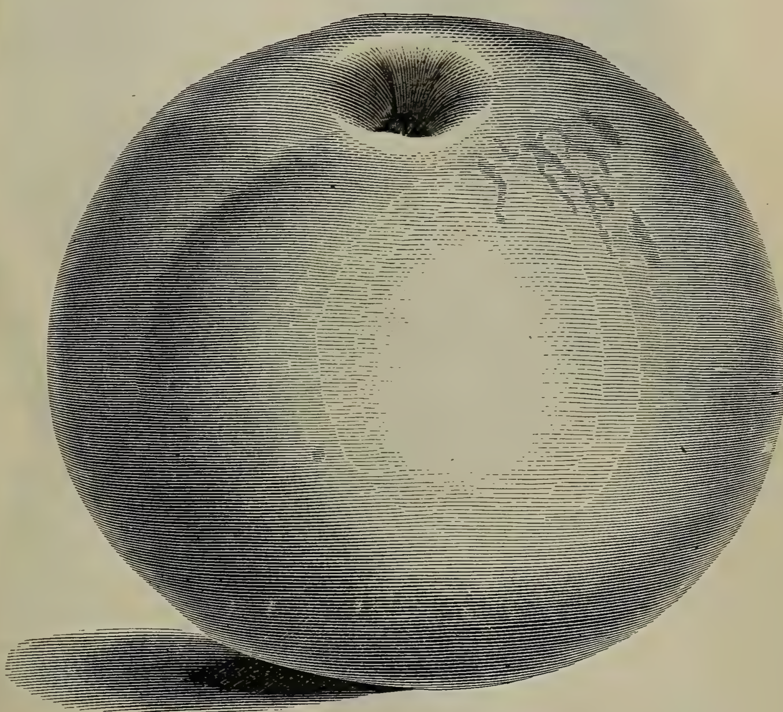
Red Astrachan.—(Plate 1.)

Fruit.—*Size,* medium to large; *form,* roundish, tapering toward the eye; *color,* greenish yellow, mostly overspread with rich purplish crimson, a little russet near the stem, over all of which is a downy white bloom; *stem,* varying, generally short; *cavity,* narrow; *calyx,* large, partially closed; *basin,* shallow, uneven; *flesh,* white, crisp, juicy, acid; *core,* small; *seeds,* ovate, dark brownish black; *season,* August. *Wood,* clear reddish chesnut, with many white specks; *leaves,* roundish, oblong, thick. The tree is a vigorous, stout, short-jointed, upright, regular grower, forming a very handsome head, and apparently adapting itself to all soils and locations. It comes early into bearing, and bears annually a fruit always fair and handsome, somewhat too acid for dessert, unless very well ripened, but always valuable in the kitchen, and so beautiful, and bearing carriage so well, as to make it especially desirable for marketing purposes.

Red June.

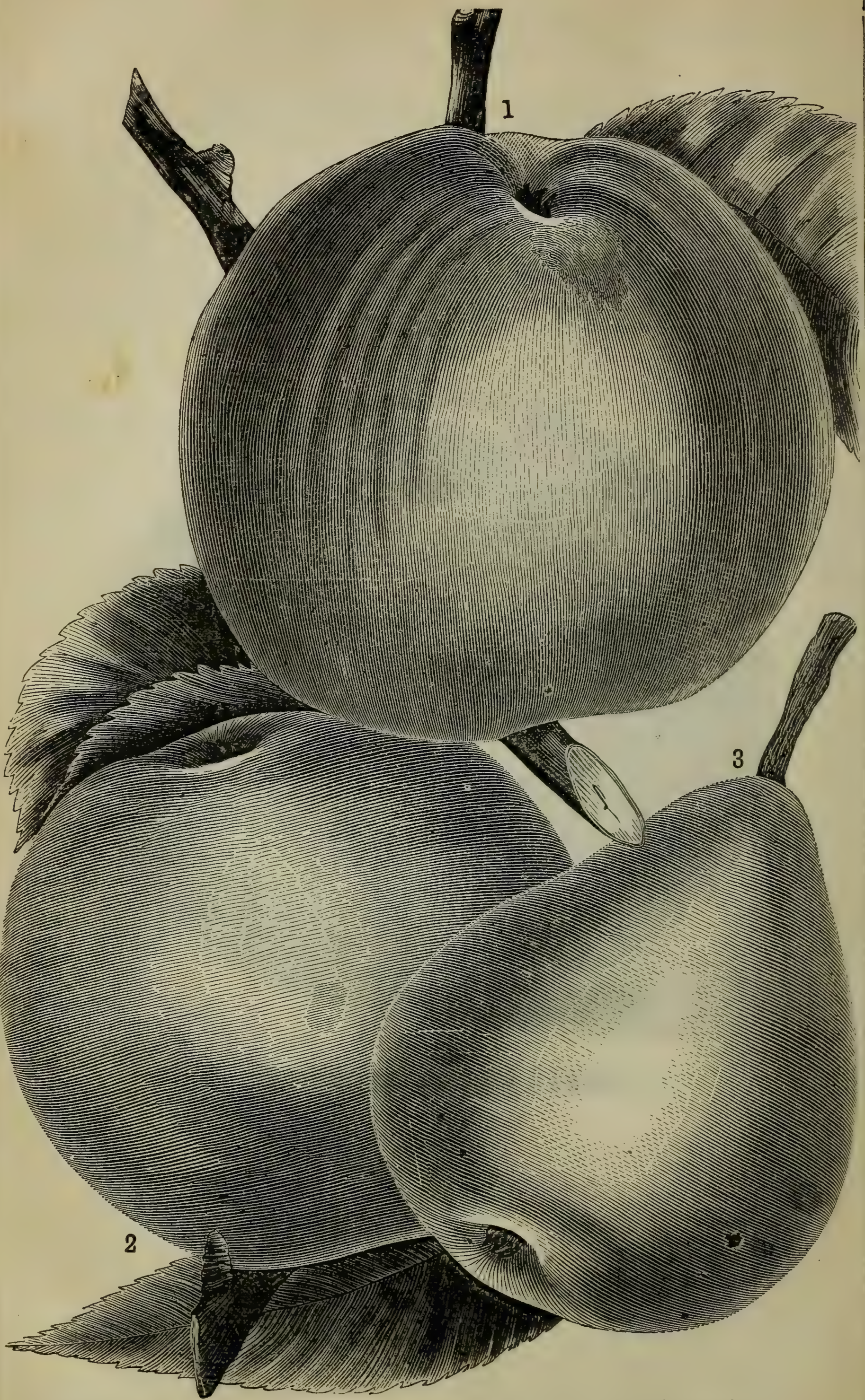
CAROLINA RED JUNE—BLUSH JUNE.

Fruit.—*Size,* medium; *form,* generally oblong conical, occasionally flattened; *color,* green in the shade, changing rapidly at maturity to a fine rich dark red or crimson; *stem* and *cavity,* vary in specimens; *calyx,* closed segments, long reflexed; *basin,* shallow; *flesh,* white, fine grained, juicy, sub-acid, not rich; *core,* large; *season,* among the earliest of summer sorts. Trees vigorous, healthy, and hardy throughout southern Illinois, Missouri, and other sections, where it is most popular; early and abundant regular bearers; very valuable for market purposes.



RHODE ISLAND GREENING.

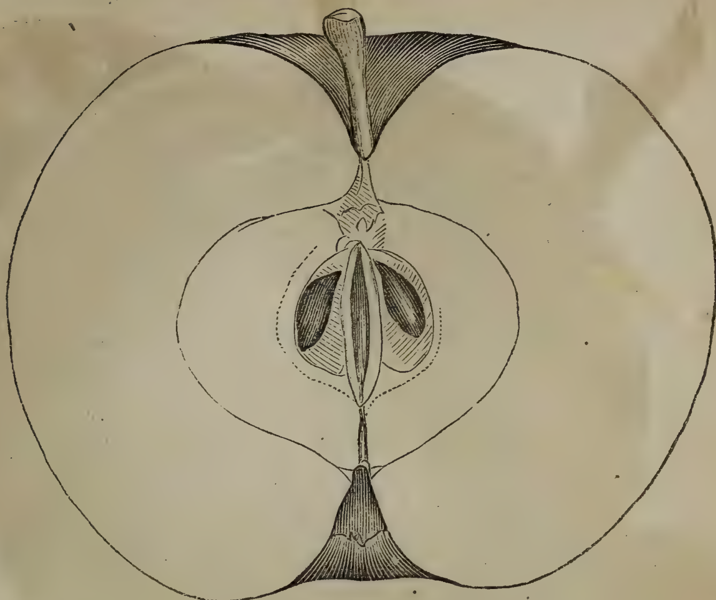
Plate XII.



1. Northern Spy. 2. Early Harvest. 3. Belle Lucrative.

Rhode Island Greening.—(Plate 11.)

BURLINGTON GREENING—JERSEY GREENING.



Fruit.—*Size*, large; *form*, roundish, flattened, sometimes angular; *color*, green, becoming yellowish when fully matured, with a dull brownish blush on sun-grown specimens, many rough russet dots and patches; *stem*, medium; *cavity*, open; *calyx*, closed, rather small and woolly; *basin*, medium, sometimes slightly furrowed; *flesh*, yellowish, tender, slightly aromatic, with a lively acid juice; *core*, small; *seeds*, ovate, pointed; *season*, winter. The tree of the Rhode Island greening is of a broad-spreading habit, medium sized shoots, healthy, broad leaves, and throughout the northern States, or sections, its presence in orchard or garden, for kitchen or table use, cannot be dispensed with. It is a regular, abundant bearer; but in southern Ohio, Indiana, and other southwestern sections, it drops its fruit too early for late keeping.

Roxbury Russet.

BOSTON RUSSET—MARIETTA RUSSET—PUTNAM RUSSET.

Fruit.—*Size*, medium to large; *form*, roundish flattened, often angular; *color*, dull green, overspread with brownish yellow russet, occasionally a faint blush on the sunny side; *stem*, slender; *cavity*, medium; *calyx*, closed; *basin*, round, moderate depth; *flesh*, greenish white, moderately juicy, mild sub-acid; *core*, compact; *seeds*, defective; *season*, winter. A spreading, and, while young, a crooked-growing tree. The Roxbury russet is pretty extensively cultivated, and proves profitable on account of its productiveness, its thick skin causing it to keep well, and hence enabling it to be taken long distances to market, and at a time when most winter sorts are gone. As a table fruit it is not, however, of more than second quality.

Smith's Cider.

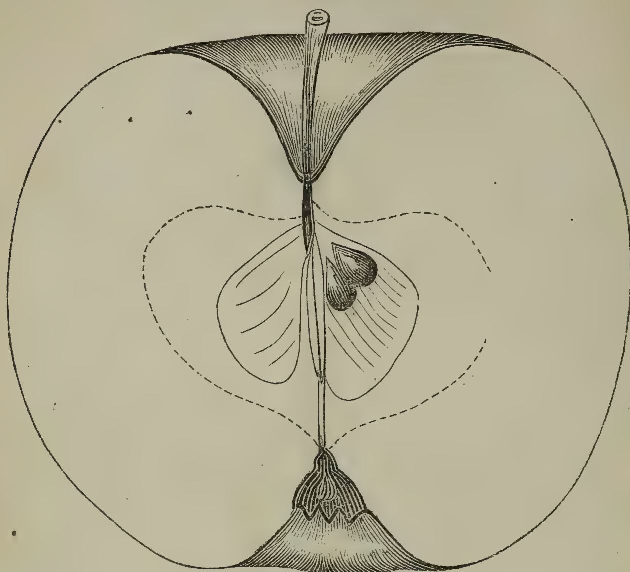
SMITH'S SUPERB.

Fruit.—*Size*, medium to large; *form*, roundish flattened; *color*, bright red and yellow, mostly red; *stem*, varying; *cavity*, regular; *calyx*, half closed with

long segments; *flesh,* yellowish white, juicy, sub-acid; *core,* medium; *season* early winter. The tree of this variety makes a regular, well-formed head, and produces good, regular crops of smooth, fair, handsome fruit, that is much esteemed, although of a negative character.

Tolman's Sweeting.

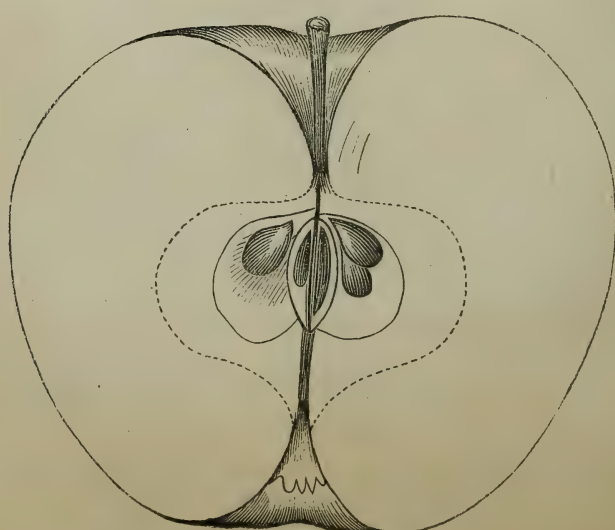
TALLMAN'S SWEETING—BROWN'S GOLDEN GATE.



Fruit.—*Size,* medium; *form,* roundish, slightly conical; *color,* light yellow, with a greenish line from stem to apex; *stem,* long, slender; *cavity,* wide, regular; *calyx,* medium; *basin,* moderate depth, furrowed; *flesh,* white, firm, very sweet; *core,* medium; *seeds,* light brown; *season,* winter. The Talman's Sweeting has dark colored wood of an upright, spreading, strong, rapid growth, producing regularly great crops of fruit, especially valuable for stock and for baking.

Wine Sap.

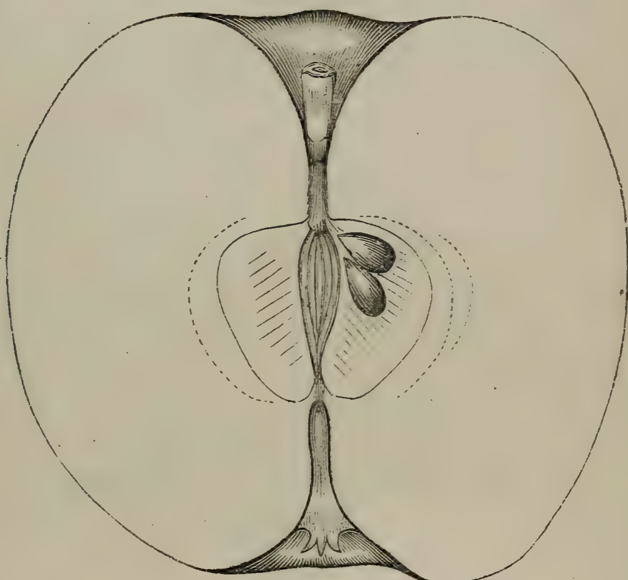
WINE SOP.



Fruit.—*Size,* medium; *form,* ovate, conical, flattened at base, sometimes roundish conical, occasionally angular and slightly ribbed; *color,* when grown north, a bright, clear red, stained and striped with darker shades, and with spots of light yellow; grown south, the dark red becomes most prominent, while the patches of light yellow at base are more often seen; it is also more irregular or angular in form, and often has russet about the stem; *stem,* varying in length, slender; *cavity,* narrow, deep; *calyx,* small, nearly closed; *basin,* abrupt, furrowed; *flesh,* yellowish, juicy, tender, sub-acid, sprightly; *core,* medium; *capsules,* hollow; *seeds,* short, ovate; *season,* early winter. Tree a slender, hardy wood, an early and very productive bearer, and apparently adapting itself to all soils and locations. Profitable for orchard or garden.

Yellow Bough.

BOUGH—LARGE YELLOW BOUGH—EARLY SWEET BOUGH—SWEET HARVEST.



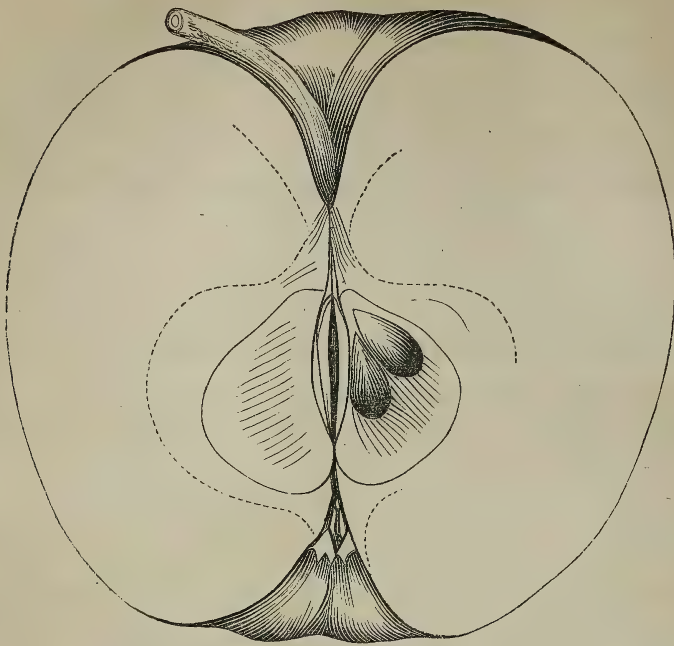
Fruit.—*Size,* large; *form,* roundish conical, ovate; *color,* greenish, becoming pale yellow when fully ripe; *stem,* varying in length; *cavity,* deep; *calyx,* open; *basin,* narrow, deep; *flesh,* white, tender, crisp, sprightly, sweet; *core,* medium; *capsules,* open; *seeds,* ovate, light brown; *season,* August. The Yellow Bough, or Sweet Bough, as it is often called, is a popular sort everywhere. The trees have yellowish wood, somewhat irregular, upright, spreading in form, hardy, and producing annually moderate crops of fruit, highly valued for dessert.

Yellow Bellflower.

BELLFLOWER—YELLOW BELLEFLEUR—LADY WASHINGTON.

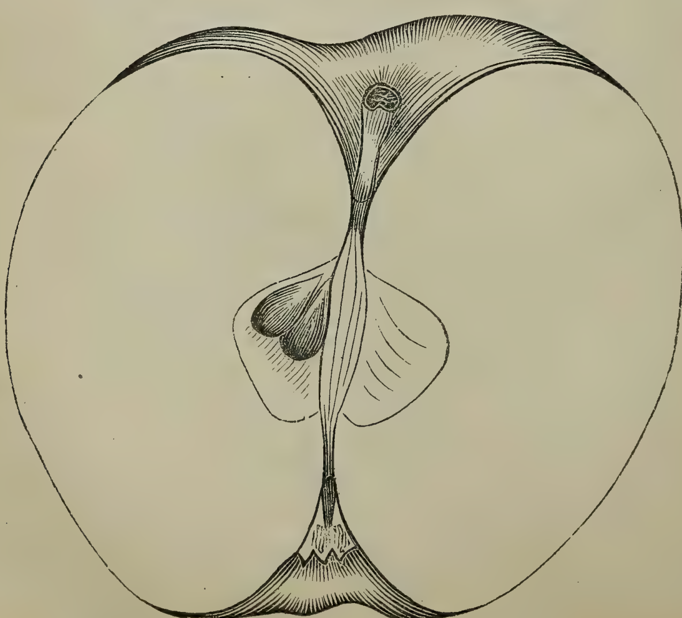
Fruit.—*Size,* medium to large; *form,* oblong, a little irregular, tapering to the eye; *color,* pale yellow, with blush next the sun; *stem,* long, slender, curved; *cavity,* deep; *calyx,* closed; *basin,* plaited, deep; *flesh,* tender, crisp, juicy, sprightly, sub-acid; *core,* large; *capsules,* long, hollow; *seeds,* large, ovate, pyriform; *season,* early winter. This variety proves very hardy everywhere;

it is a productive bearer with yellowish shoots, and its habit of producing fruit on the ends of them give it, when bearing, a rather round, drooping appear-



ance. The fruit is somewhat too acid at the north, but on the Ohio river, Missouri, and other southwestern sections, it is sub-acid and very valuable.

YELLOW NEWTOWN PIPPIN.

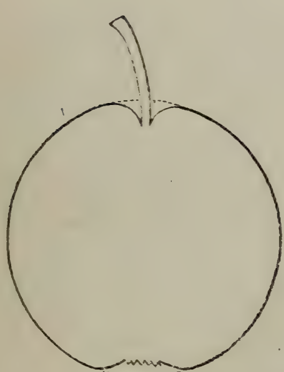


FRUIT.—*Size*, medium to large; *form*, roundish flattened, angular; *color*, clear yellow, with considerable russet from the stem, many small russet dots.

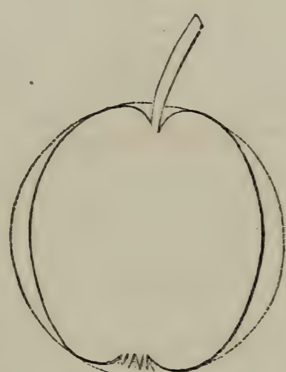
and where exposed to the sun the yellow becomes very rich and dotted with carmine; *stem*, short; *cavity*, deep; *calyx*, large, open; *segments*, short, stiff, and broad; *basin*, broad, irregular only from the slight ribbing of the fruit; *flesh*, yellowish, very firm, crisp, juicy, sub-acid; *core*, medium; *seeds*, purplish black, oblong, pyriform; *season*, late winter and spring. The trees of this variety are of slender, close-grained wood, proving hardy in the richest of soils, and requiring abundance of food to produce perfect fruit. On rich limestone soils it is, perhaps, one of the most profitable, being a hardy tree, a good bearer and great keeper, even when grown comparatively far south.

DESCRIPTIONS OF PEARS.

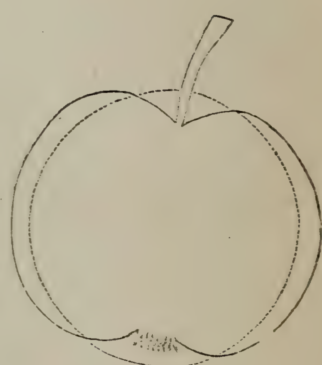
As a guide to the terms used in describing the forms of pears, we copy the forms adopted by the Massachusetts Horticultural Society, and now generally recognized by all pomologists.



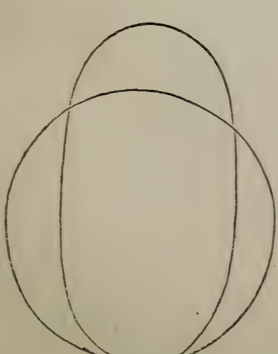
GLOBULAR.



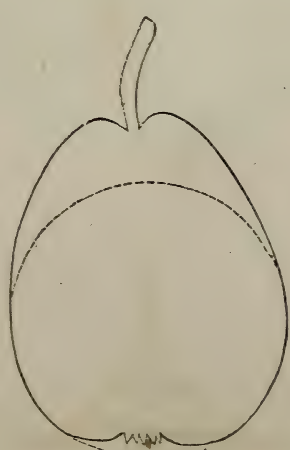
OVATE.



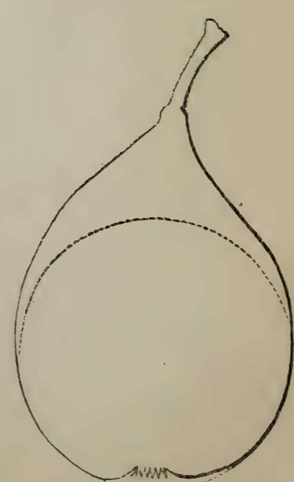
OBOVATE.



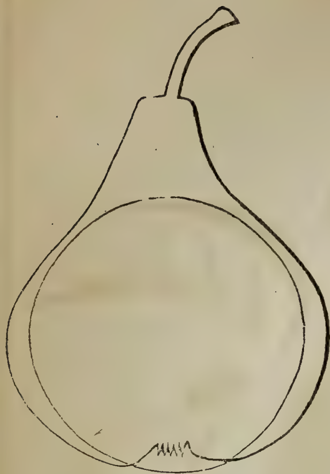
OBLONG.



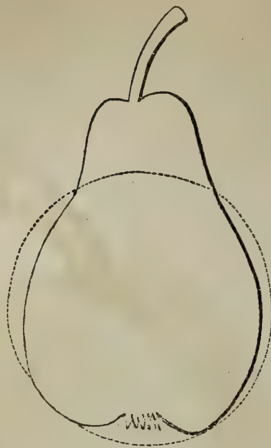
GLOBULAR; OBTUSE PYRIFORM



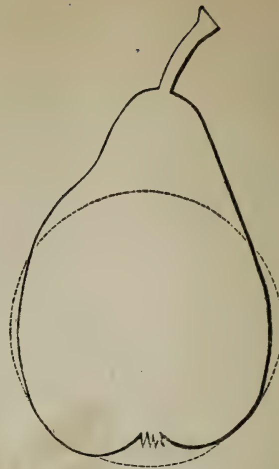
GLOBULAR; ACUTE PYRIFORM.



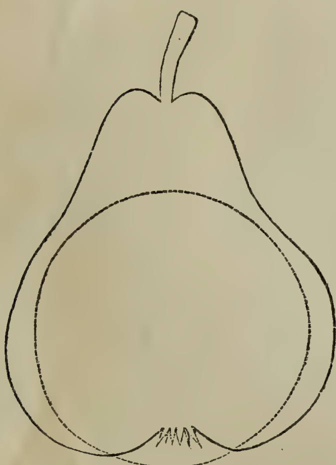
OBOVATE; ACUTE PYRIFORM.



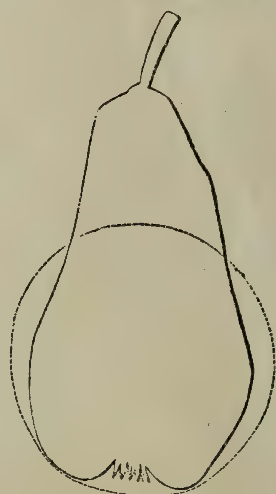
OVATE PYRIFORM.



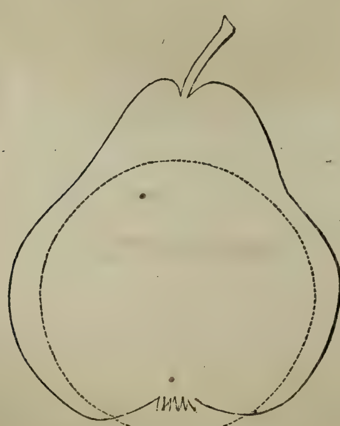
OBLONG PYRIFORM.



OBLONG OBOVATE PYRIFORM.



OBLONG OVATE PYRIFORM.

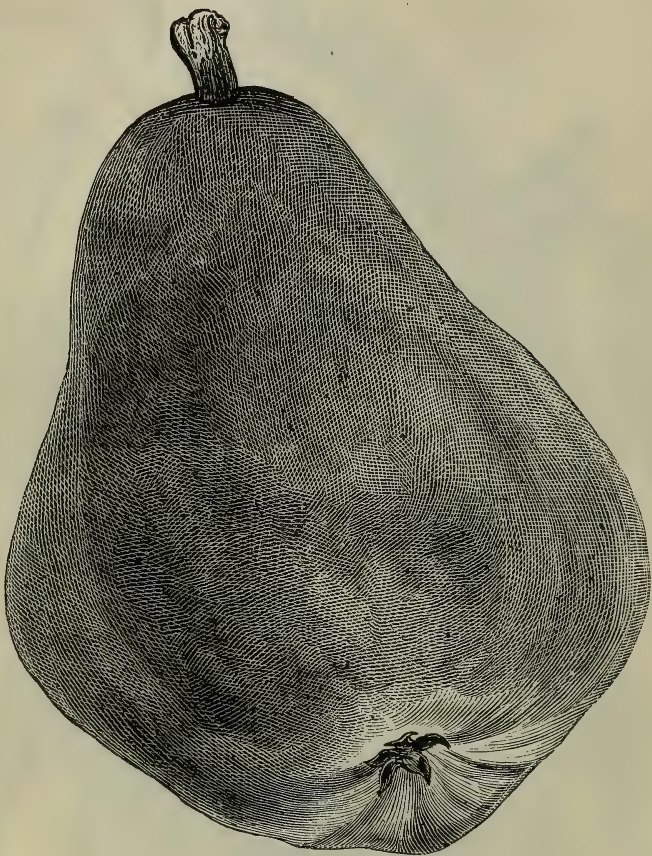


OBOVATE OBTUSE PYRIFORM.

I have divided the descriptions of pears into sections. Section No. 1 contains such varieties as have received the largest number of votes in pomological conven-

BARTLETT.

PLATE XIV.



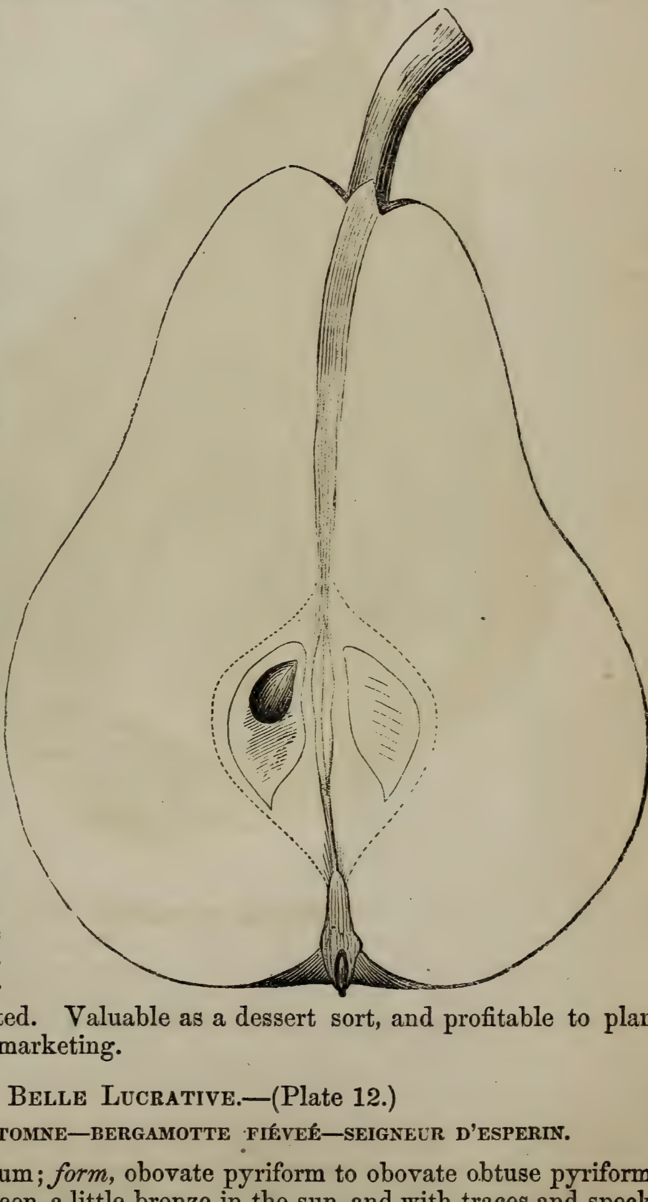
BEURRE D'ANJOU.

tions, as of superior excellence or possessing qualities worthy their continued cultivation. Section No. 2 embraces varieties that are not as widely disseminated, but in the opinions of practical growers should be more generally distributed. Section No. 3 contains such varieties as are yet new, but that exhibit qualities giving promise of their being worthy the attention of amateur fruit-growers.

SECTION 1.—*Varieties having received most votes in pomological conventions as worthy of cultivation.*

BARTLETT.—(Plate 13.)

WILLIAMS BON CHRETIEN—POIRE GUILLIAUME—WILLIAMS.



FRUIT.—*Size,* large; *form,* ovate, obtuse, pyriform; surface somewhat uneven; *color,* clear light yellow, tinged with blush in sun, when ripe; russet around the stem, and minute russet dots over the whole; *stem,* short and thick; *calyx,* medium, partly open; *basin,* shallow, furrowed; *core,* medium; *seeds,* broad, ovate; *flesh,* yellowish white, melting, juicy, musky, vinous; *season,* late summer. An English pear, introduced to this country in 1799, and now, perhaps, more generally known than any other sort. *Wood,* clear, dark yellow, with gray specks; *leaves,* medium size, ovate, acuminate, deep green. Trees upright, vigorous while young, with strong, stout annual shoots; comes early into bearing, and therefore while it succeeds well on the quince, there is no necessity of so growing it, if fruit only is wanted. Valuable as a dessert sort, and profitable to plant as an orchard sort for marketing.

BELLE LUCRATIVE.—(Plate 12.)

FONDANTE D'AUTOMNE—BERGAMOTTE FIÉVEÉ—SEIGNEUR D'ESPERIN.

FRUIT.—*Size,* medium; *form,* obovate pyriform to obovate obtuse pyriform; *color,* pale yellowish green, a little bronze in the sun, and with traces and specks of russet; *stem,* stout, about one inch long, often fleshy, wrinkled and knobby at base; *cavity,* shallow; *calyx,* short, open; *basin,* broad, shallow; *core,* medium; *seeds,* ovate, dark brown; *flesh,* white, fine, aromatic, sweet; *season,*

early autumn. This pear is of foreign origin—supposed Belgian—is a free, vigorous grower, succeeding well on pear or quince root; upright habit, and early in coming into bearing. The wood is yellowish with specks of white; a medium sized oblong oval leaf, forming a hardy tree, valuable in orchard or garden.

Beurré d'Anjou.—(Plate 14.)

NE PLUS MEURIS—NIELL—FONDANTE DU BOIS.

Fruit.—*Size,* large; *form,* long, oblong, obovate pyriform, obtuse at stem; *color,* pale yellow, dull blush and numerous small specks of russet; *calyx,* open; *segments,* thick, reflexed; *basin,* round, not deep, russeted; *stem,* short, curved, and obliquely inserted in a shallow cavity; *core,* small; *seeds,* long, pointed; *flesh,* yellowish white, melting, juicy, vinous, delicious to the core; *season,* autumn. The origin of this pear is not fully clear. It is, however, foreign, and was first introduced and fruited in this country by Hon. Marshall P. Wilder, of Boston, Mass. Had Mr. Wilder done nothing more for the benefit of man than merely to introduce and disseminate this one fruit, his name should ever be held in the highest esteem, for the fruit is indispensable to all collections, whether for orchard market purposes or for family use. The tree succeeds upon quince or pear roots; is a rapid but healthy grower, with strong shoots, forming a fine pyramidal shape, until, loaded with fruit from the ends of its branches, it becomes somewhat diverging. So much is it valued by those who have grown it that one man has one-fifth of his entire orchard of this sort. The wood of young shoots is short jointed, yellowish olive color, with gray specks, large, oblong leaves, rounded at the base.

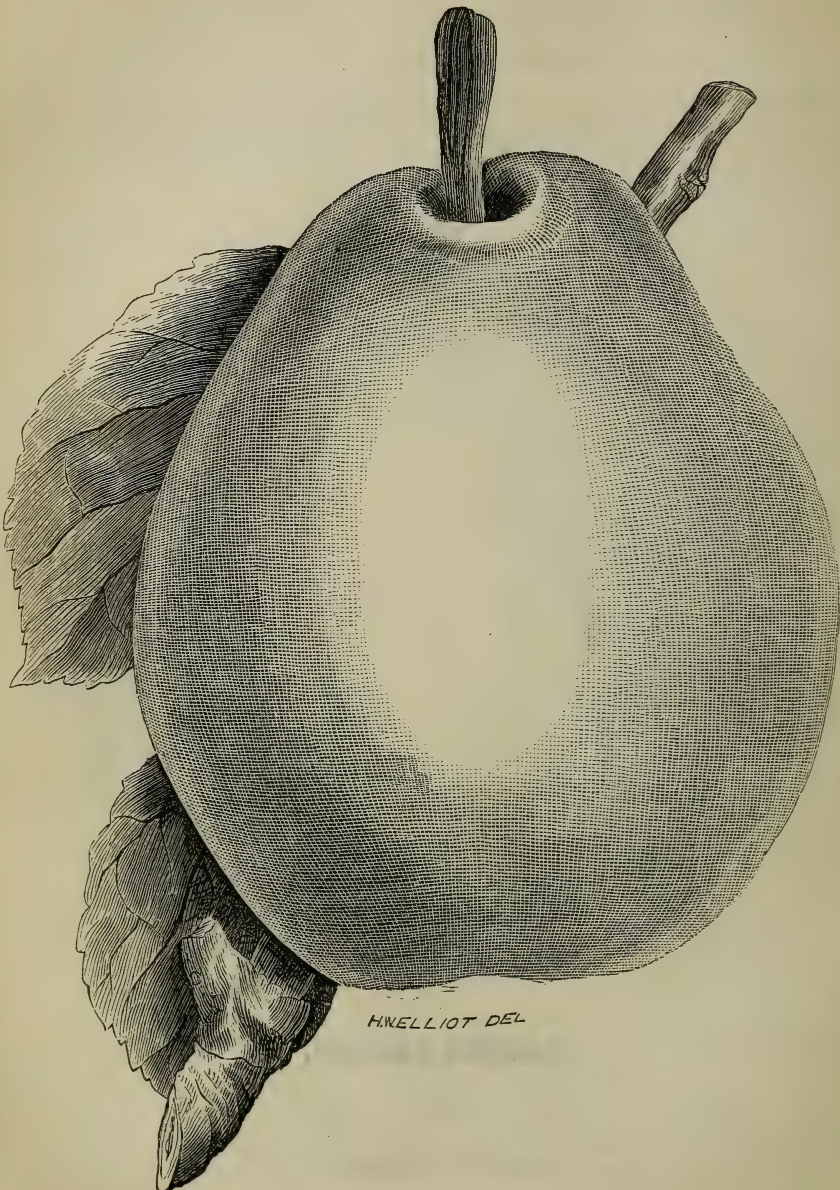
Beurré Easter.—(Plate 15.)

DOYENNÉ D'HIVER—DOYENNÉ DU PRINTEMPS—BERGAMOTTE DE LA PENTECOTE—BEURRÉ DE LA PENTECOTE—BEURRÉ D'HIVER DE BRUXELLES—BEURRÉ ROUPÉ—PATER NOSTER—DU PÂTRE—BEURRÉ DE PÂQUES—PHILLIPPE DE PÂQUES—CANNING—BEZI CHAUMONTELLE TRÉS GROS—SIEGNEUR D'HIVER.

Fruit.—*Size,* large; *form,* globular, obtuse pyriform; *color,* yellowish green, with russet spots, with a brownish russet cheek on specimens grown in the sun; *stem,* generally short; *cavity,* rather deep; *calyx,* generally small; *basin,* nar-

BEURRE EASTER.

PLATE XVI.



BEURRE DIEL.

row, rather deep; *core*, medium; *seeds*, long, ovate, acute pyriform; *flesh*, white, buttery, juicy, sweet; *season*, late winter. This is an old foreign sort that succeeds finely on the quince root, producing large crops of fruit that keep longer in winter than any other well-known sort. The trees are perfectly hardy; the *wood*, strong, short-jointed, reddish yellow, with distinct white spots; *leaves*, oblong, ovate.

Beurré Diel.—(Plate 16.)

DIEL—DIELS BUTTERBIRNE—DOROTHÉE ROYALE—GROSSE DOROTHÉE—BEURRÉ ROYAL—DES TROIS JOURS—DE MELON—MELON DE KOPS—BEURRÉ MAGNIFIQUE—BEURRÉ INCOMPARABLE.

Fruit.—*Size*, large; *form*, obovate, obtuse pyriform; *surface*, rather uneven; *color*, dull green, bright yellow when mature; suffused shades and patches of light pea green, russet specks, and scattered russet and greenish brown patches; *stem*, stout and slightly curved; *cavity*, narrow; *calyx*, medium, open, long segments; *basin*, abrupt, ribbed; *core*, large; *seeds*, dark brown; *flesh*, yellowish white, rather coarse, especially near the core; juicy, melting, perfumed; *season*, late autumn. *Wood*, olive green, with a few oval ash-colored spots, becoming olive brown with grayish specks; *leaves*, large, roundish; *shoots*,

vigorous, strong. It succeeds well on pear or quince root, but the fruit is larger and finer on the quince than on the pear, until the latter acquires considerable age. It is very productive, and a valuable market sort.

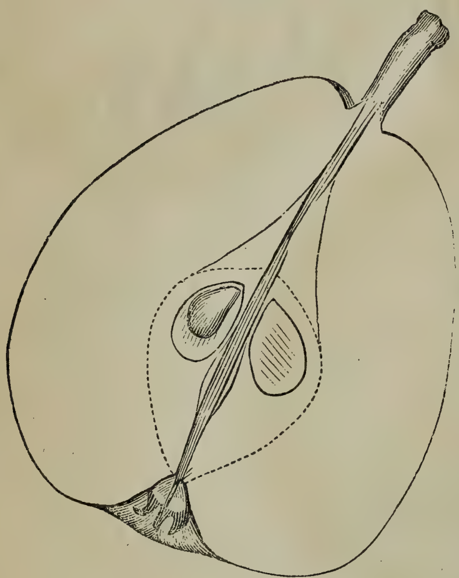
Bloodgood.

EARLY BEURRÉ.

Fruit.—*Size,* medium or below; *form,* ovate, obovate; *color,* yellow, with russet marblings and dots; *calyx,* open; *stem,* fleshy at base; *core,* small; *flesh,* yellowish white, melting, juicy; *season,* midsummer. The Bloodgood is probably a native, and was first disseminated from Flushing, Long Island. It is a moderate grower, with reddish brown, short-jointed wood, very hardy and a regular bearer; the fruit is high flavored, and is valued for the dessert.

Buffum.—(Plate 17.)

BUFFAM.



Fruit.—*Size,* medium; *form,* oblong obovate, obtuse at stem; *color,* brownish green, becoming yellow, with bright suffused red in sun; brown dots and traces of russet; *stem,* half an inch to an inch long, slight depression; *calyx,* with short, recurved segments; *basin,* round, shallow; *core,* rather small; *seeds,* dark brown; *flesh,* white, buttery, melting, juicy, sweet, pleasantly perfumed; *season,* early autumn. The Buffum is a native of Rhode Island, a remarkably erect and vigorous grower, with reddish brown, short-jointed wood, and large, roundish, ovate, deep green leaves, proving perfectly hardy in all localities. The fruit is not of the highest excellence, but its great bearing qualities, its hardihood, beautiful form, requiring little or no pruning to keep it in shape, all render it one of the most desirable varieties for the market orchard, or as a sort to be planted in ornamental grounds. It is said by some not to succeed on the quince; the writer has, however, grown and fruited it now fourteen years on the quince, and the trees are yet healthy and vigorous

Dearborn's Seedling.

Fruit.—*Size,* below medium; roundish, inclining to obovate, narrowing a little to the stem; *color,* pale yellow, with fawn russet at base of stem, and surface dotted with small russet spots; *calyx,* with short, thick segments; *stem,* long, slender, curved; *core,* medium; *seeds,* dark brown, long pointed; *flesh,* yellowish white, fine-grained, melting, juicy, sweet, delicately perfumed; *season,* late summer. This variety originated at Roxbury, Massachusetts; the trees are upright, spreading in form, with long shoots of a reddish brown and a medium sized, ovate, smooth leaf. Upon the pear root it is not an early bearer, but succeeds well on the quince, and produces fair crops of fruit, very desirable for the table.

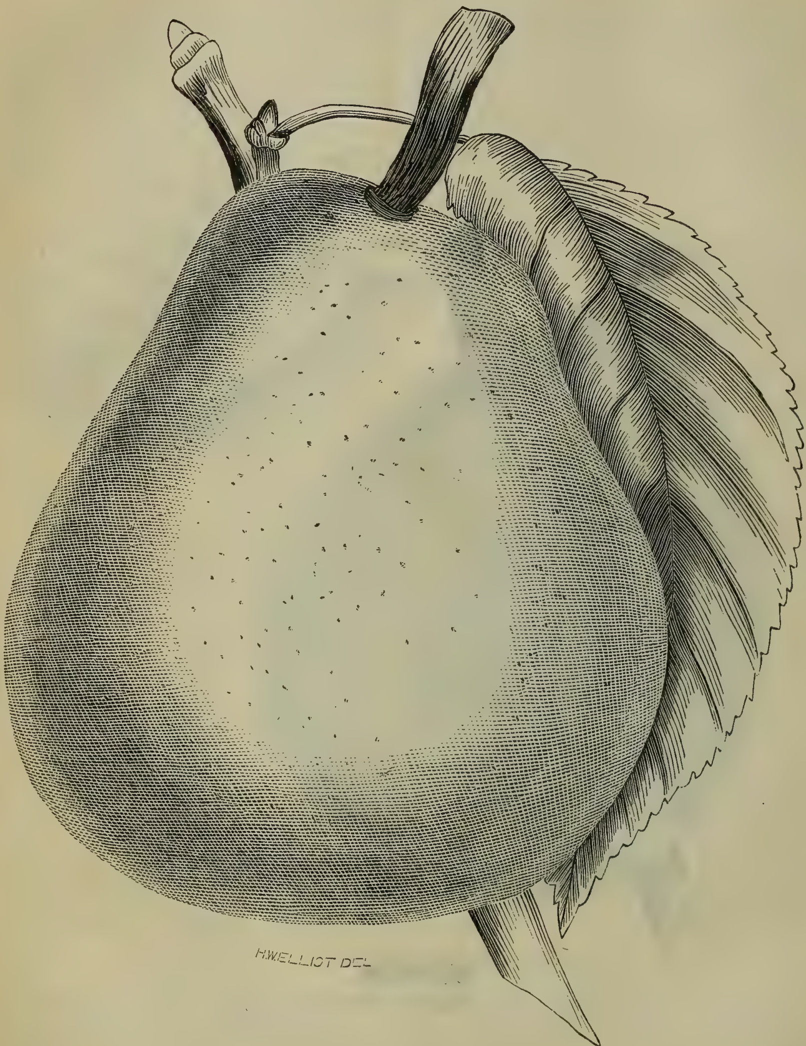
Doyenné Boussock.—(Plate 18.)

BEURRÉ DE MESSODE—DOYENNÉ BOUSSOCK NOUVELLE—PLYMOUTH—DOUBLE PHILLIPPE.

Fruit.—*Size,* large; *form,* varying, usually globular, obtuse, obovate, pyriform; *color,* yellow, with tracings of russet and large russet specks; *stem,*

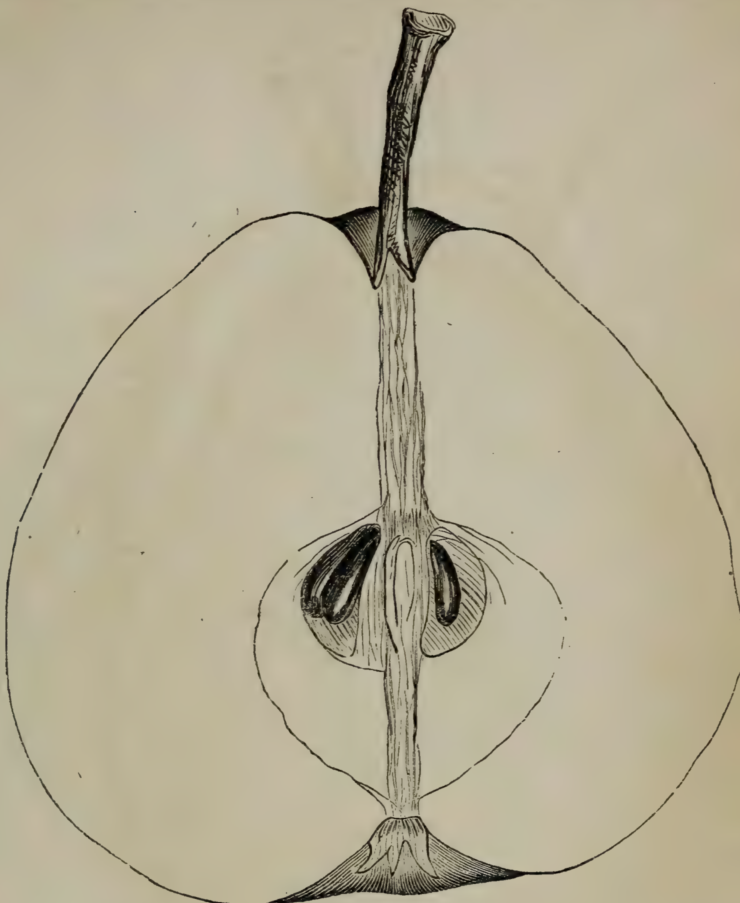
BUFFUM.

Plate XVIII.



DOYENNE BOUSSOCK.

short, stout, fleshy at base; *cavity*, shallow; *calyx*, medium, open; *core*, medium; *seeds*, small, almost black, abortive; *flesh*, yellowish white, rather coarse, melting, juicy, vinous, sweet, perfumed; *season*, early to midautumn. Of foreign origin, of a spreading, upright habit, succeeding finely either on



pear or quince stock, and coming early into bearing. The Doyenné Boussock proves valuable in the quality of its fruit for the dessert, and profitable for market orcharding. *Wood*, short jointed, clear yellowish brown, few pale brown specks; *leaves*, large, roundish, obovate, thick, deep green.

Doyenné, White.

WHITE DEAN—VIRGALIEU—BUTTER PEAR—ST. MICHAEL—YELLOW BUTTER—WHITE BEURRÉ—WHITE AUTUMN BEURRÉ—REGNIER—WARWICK BERGAMOTTE—SNOW PEAR—PINE PEAR—DOYENNÉ BLANC—BEURRÉ BLANC—POIRE DE SIMON—POIRE NEIGE—POIRE DE SEIGNEUR—POIRE MONSIEUR—VALENCIA—CITRON DE SEPTEMBER—BONNE-ENTE—KAISERBIRNE—KAISER D'AUTOMNE—DE CHANTS BIRNE—NOUVELLE D'OUEF.

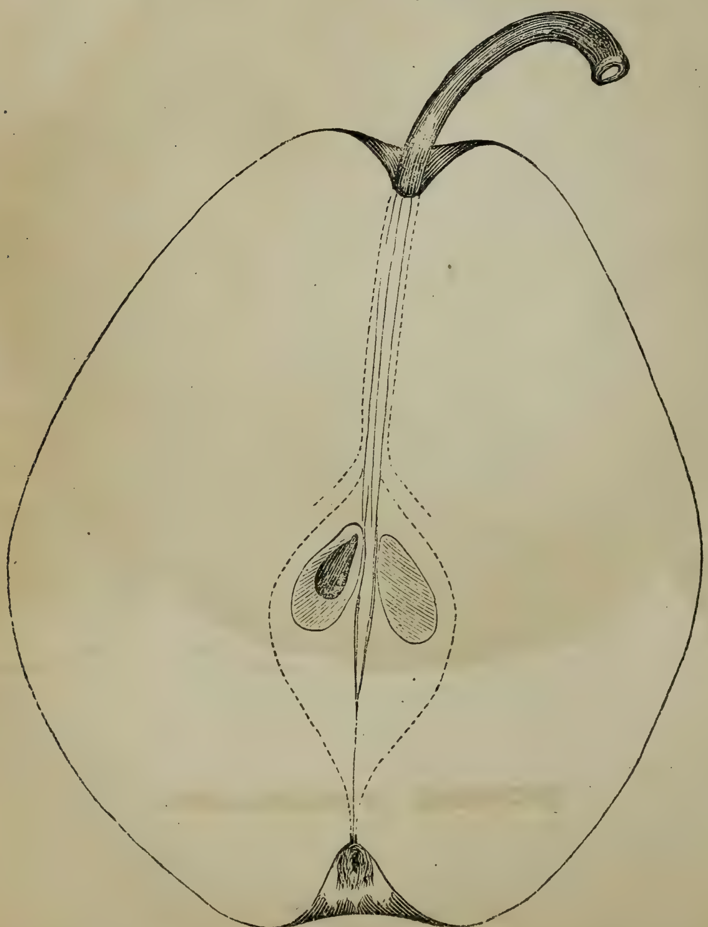
Fruit.—*Size*, medium or above; *form*, regular, obovate; *color*, clear, pale yellow, regularly sprinkled with small dots, and often with a fine red cheek, *stem*, brown, from three-fourths of an inch to one and a half long, a little curved; *cavity*, small, round; *calyx*, small, closed; *basin*, shallow, smooth, delicately plaited; *core*, small; *flesh*, white, fine-grained, melting, juicy, buttery, slightly aromatic, delicious; *season*, autumn. An old French variety, of moderate, strong, upright, spreading growth, succeeding well on pear or quince roots, coming early into bearing, the White Doyenné is, at the west and southwest, one of the best pears, and most hardy as well as profitable trees that are

grown. In some sections of the New England States it cracks and spots its fruit from some unknown cause, and similar results have recently appeared in Northern and Western New York, where heretofore it has been very healthy and perfect.

Duchesse d'Angouleme.—(Plate 19.)

Fruit.—*Size,* large to very large; *form,* oblong, obovate obtuse pyriform, with a very uneven surface; *color,* yellow, often tinged with blush on the sunny side, scattered, irregular, russety patches, and large russet dots; *stem,* about an inch long, stout, and largest at extreme end; *cavity,* round, deep; *calyx,* small to medium, generally closed, sometimes partially open, segments short; *basin,* deep, uneven, or furrowed; *core,* below medium; *seeds,* plump, oblong, pyriform; *flesh,* white, melting, juicy, sugary; *season,* late autumn. This variety is of French origin, and on account of its immense size, hardihood of tree, and productive habit on the quince root, it has become well known. The tree is upright and stocky in its growth, wood rather long-jointed, stout, brownish yellow, with whitish specks; ovate-shaped leaves of a bright green, and although its quality is not of the highest excellence for the dessert, its size and productiveness on the quince make it a profitable market sort.

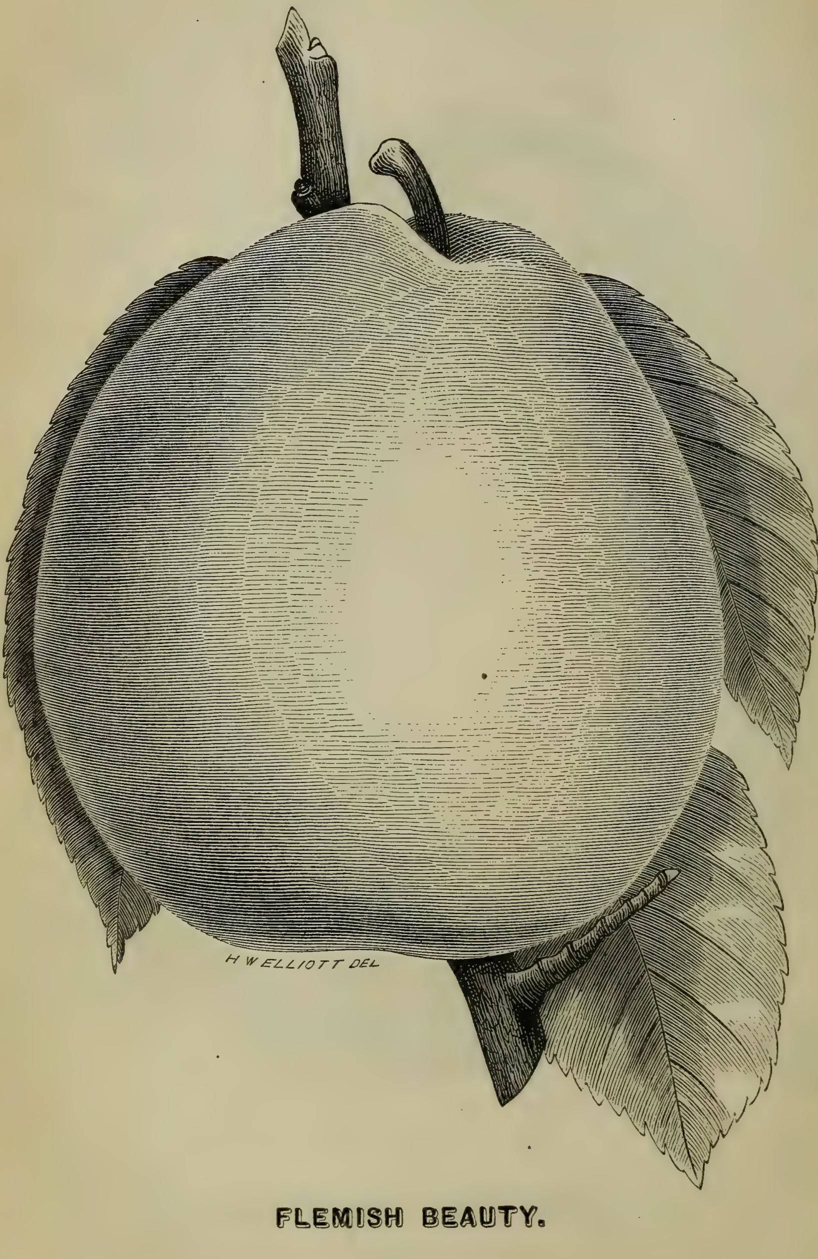
Flemish Beauty.—(Plate 20.)



BELLE DE FLANDERS—BOUCHE NOUVELLE—IMPERATRICE DE FRANCE—BOSC SIRE—BOSCH—POIRE DAVY.

DUCHESSE D'ANGOULEME.

Plate XX.



FLEMISH BEAUTY.

LAWRENCE.

Plate XXII.

LOUISE BONNE DE JERSEY.

Fruit.—*Size,* large; *form,* oblong, obtuse, obovate; *color,* pale yellow, mostly covered with patches and marblings of light russet, and in sun rich reddish brown; *stem,* one to one and a half inch long; *cavity,* narrow, deep; *calyx,* short, open; *basin,* round, small; *core,* medium, with oblong capsules; *seeds,* small, oblong, pyriform, pale brown; *flesh,* yellowish white, not very fine-grained, juicy, melting, sugary, aromatic; *season,* early autumn. The Flemish Beauty is of foreign origin—Belgian—a vigorous, healthy, hardy tree, producing freely at four to six years old, when on the pear root, and proving very profitable as an orchard sort. It is said not to succeed well on the quince, but trees planted by the writer in 1850 are yet vigorous and healthy, and have annually produced large crops. It sets its fruit very evenly over the tree; hence it is generally uniform in size. The wood is a clear reddish brown, with whitish specks, slender, and short-jointed; leaves, medium size, ovate, deep glossy green.

Glout Morceau.

BEURRÉ D'HARDENPONT — COLMAR D'HIVER — BEURRÉ D'HIVER NOUVELLE — LINDEN D'AUTOMNE—GOT LUC DE CAMBRON—ROI DE WURTEMBERG.

Fruit.—*Size,* large; *form,* obovate, obtuse pyriform, often angular, and surface rough; *color,* pale greenish yellow, russeted around the stem, and traces of russet and greenish gray russet specks over the whole surface; *stem,* one to one and a half inch long, often inserted without cavity, but flesh raised one side; *calyx,* medium, segments, half reflexed; *basin,* rather deep, often furrowed or uneven; *core,* large; *seeds,* large, ovate, pointed; *flesh,* white, fine-grained, buttery, sugary, perfumed; *season,* early winter. This pear is from Belgium, is very hardy and successful when grown on the quince; but on the pear it is too long in arriving at maturity to be profitable. The wood is dark olive, with distinct grayish specks, short jointed; leaves, broad, thick, blue green, wavy at the edge. It is a good bearer on the quince, and for those who prefer a sugary to a vinous fruit, it is extremely desirable as an early winter variety.

Louise Bonne de Jersey.—(Plate 22.)

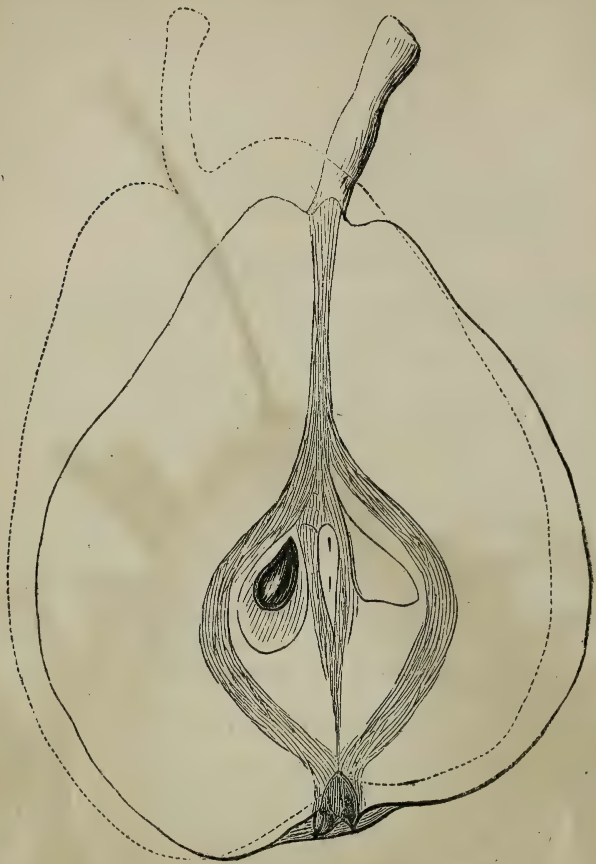
LOUISE BONNE DE AVRANCHES—BEURRÉ OU BONNE LOUISE D'AURADORÉ—BERGAMOT D'AVRANCHES—POIRE DE JERSEY.

Fruit.—*Size,* large; *form,* oblong, pyriform; *color,* green, becoming yellow green when mature, bright glossy red in the sun, dotted with grayish russet specks with a margin of red when grown in sun; *stem,* about one inch long, moderately stout, a little curved, fleshy enlargement at base; *calyx,* open, with large reflexed segments; *basin,* shallow; *core,* small; *seeds,* long, ovate, pointed, light brown; *flesh,* white, melting, very juicy, vinous, aromatic; *season,* mid-autumn. This is a French pear, so universally and perfectly successful when grown on the quince, that it has come to be indispensable in the smallest collections. The tree has naturally an erect, regular habit, and, even without pruning, forms a very handsome tree. Upon the pear it does not mature the fruit with high flavor until the trees are old; but upon the quince it comes so early into bearing, and continues yearly to produce such large crops of fine fruit, that the garden cannot be complete without it, and some market-growers plant nine of this to one of any other sort. *Wood,* dull brownish or reddish olive, with whitish specks, long-jointed; *leaves,* oblong oval, nearly flat.

Lawrence.—(Plate 21.)

Fruit.—*Size,* medium or above; *form,* long, obovate, obtuse at stem; *color,* pale yellow, marbled with dull green, small dark specks and russet at each end, sometimes a tinge of red on the side exposed to sun; *calyx,* small, closed; *basin,* open, furrowed; *stem,* medium length, stout, swollen at the junction with

the tree; *cavity*, round, with a lip; *core*, medium; *seeds*, small, dark brown; *flesh*, yellowish white, juicy, rich, sugary, slightly perfumed, gritty at core; *season*, late fall to midwinter. The Lawrence is a native of Flushing, Long Island. As a winter sort it possesses the property of keeping without shrivelling, and ripening off, with ordinary care, as well as an apple. The tree is



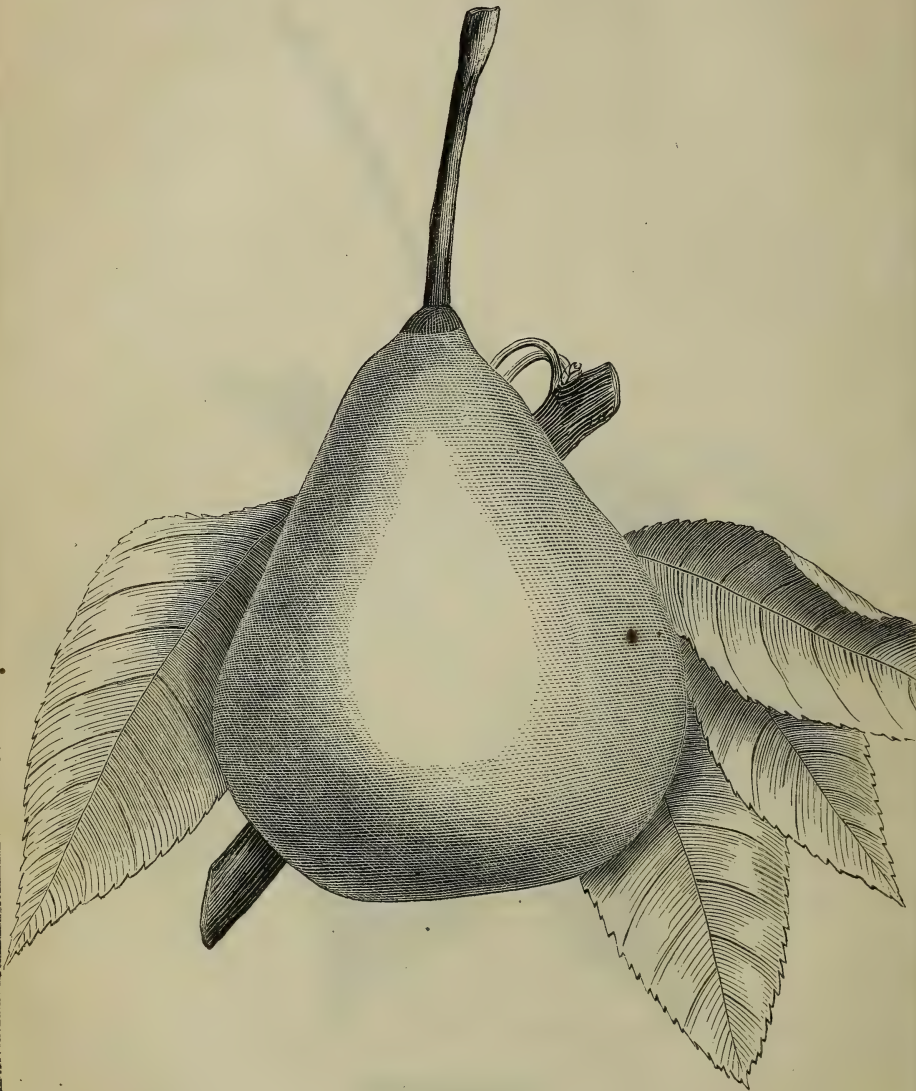
vigorous, upright, regularly branched, with slender, annual, straight shoots, and small, thick, oblong, ovate leaves of a dark glossy green, proving hardy, an early annual and abundant bearer, and succeeding either on quince or pear root. As a market orchard sort, as well as for small gardens, it is extremely valuable, coming in eating at a time when there are few good pears.

Rostiezer.—(Plate 23.)

Fruit.—*Size*, small; *form*, obovate pyriform; *color*, dull green, reddish brown cheek in sun, dark green spots and traces of thin russet; *stem*, long, slender, obliquely inserted on one side, without depression; *calyx*, medium, open, with short segments; *basin*, shallow, with uneven angles; *core*, small; *seeds*, ovate, pointed, pale brown; *flesh*, rather coarse, melting, juicy, sweet, perfumed; *season*, late summer. The origin of this pear is unknown. The tree is of a vigorous, strong, healthy growth, becoming spreading and irregular, and, like the Madeleine, requiring care in pruning, to form it while young, otherwise the strong, bare shoots that it makes are liable to be destroyed by extreme changes of temperature. The young wood is a clear reddish brown, dotted with russet specks; the leaves are medium size, roundish, ovate, thick, and of a dull, dark green color.

ROSTIEZER.

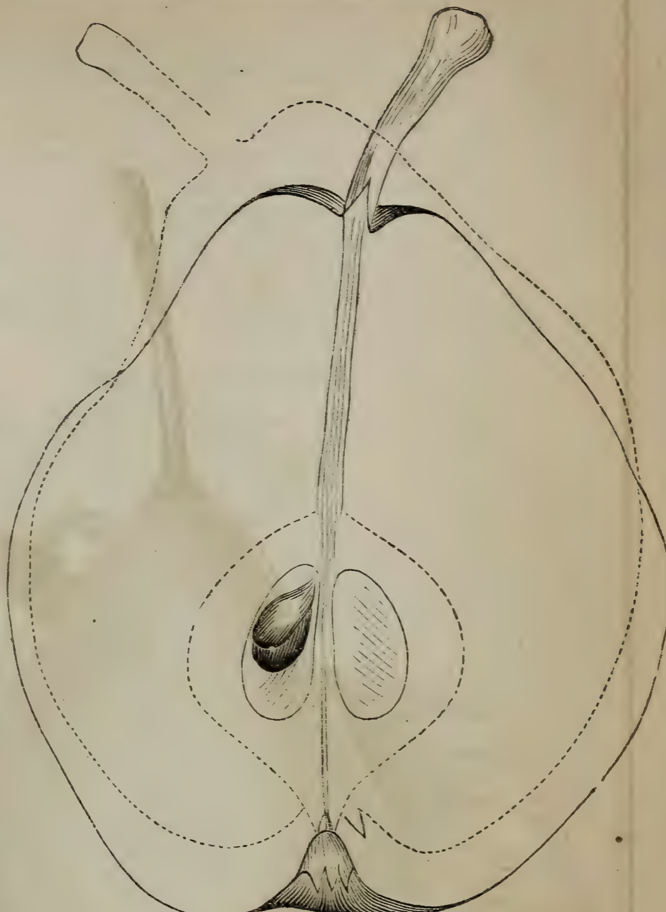
PLATE XXIV.



TYSON.

ONONDAGA.

SWAN'S ORANGE—ONONDAGA SEEDLING.



FRUIT.—*Size*, large; *form*, ovate, oblong, obovate, obtuse, pyriform; *color*, pale greenish yellow, becoming golden yellow at maturity, many gray russet dots, and occasionally a dull blush in the sun; *stem*, one to one and a half inch long, inserted without depression, but with lip of fruit folded unevenly around it; *calyx*, rather small, closed; *basin*, shallow, abrupt, and marked with patches of cinnamon russet; *core*, compact; *seeds*, small; *flesh*, white, juicy, slightly granular, vinous; *season*, autumn. An American variety, originating in Connecticut, the Onondaga, has proved a hardy tree, prolific of large and fine fruit, either upon the pear or quince stock. *Wood*, stout, short jointed, clear olive, dotted with large grayish specks; *leaves*, large, oblong, thick, deep green.

SECKEL.—(Plate 1.)

FRUIT.—*Size*, small to medium; *form*, rounded, obtuse, pyriform; *color*, brownish green at first, becoming yellowish brown, with a lively red russet cheek and small gray dots; *stem*, about a half inch long, moderately stout, inserted in a small narrow cavity, highest on one side; *calyx*, small, open, with short, stiff, incurved segments; *basin*, shallow; *core*, small; *seeds*, broad, ovate; *flesh*, yellowish white, juicy, very sugary, melting, spicy, aromatic; *season*, early autumn. The Seckel pear is too well known to require a word in its favor. It originated in Passyunk township, on the Delaware river, and was named after a Mr. Seckel, who then owned the property. The tree is a stocky, short-jointed grower, never making more than a moderate sized, round, compact, headed tree. It is admirably adapted to bleak, exposed locations, and to very rich soils. It does best on the pear root, and should be root-pruned in order to bring it to early maturity.

TYSON.—(Plate 24.)

FRUIT.—*Size,* below medium; *form,* roundish pyriform, irregular; *color,* dull yellow, shaded with red in the sun, little russeted, and with numerous black specks; *stem,* rather long, moderately stout, curved and obliquely attached to the fruit by a fleshy junction swollen on one side; *calyx,* open, with short segments; *basin,* round, shallow; *core* and *seeds,* small; *flesh,* white, fine-grained, juicy, melting, sugary, aromatic; *season,* midsummer. An American variety, originating at Jenkintown, near Philadelphia, about 1794. The tree is a very vigorous, erect, upright grower, forming a handsome pyramidal head, and comes tardily into bearing when grown on pear roots. It succeeds upon the quince, but as yet has not been grown long enough on that to warrant its planting thereon extensively. *Wood,* dull reddish brown, whitish specks; *leaves,* medium size, ovate, deep green; *flowers,* small.

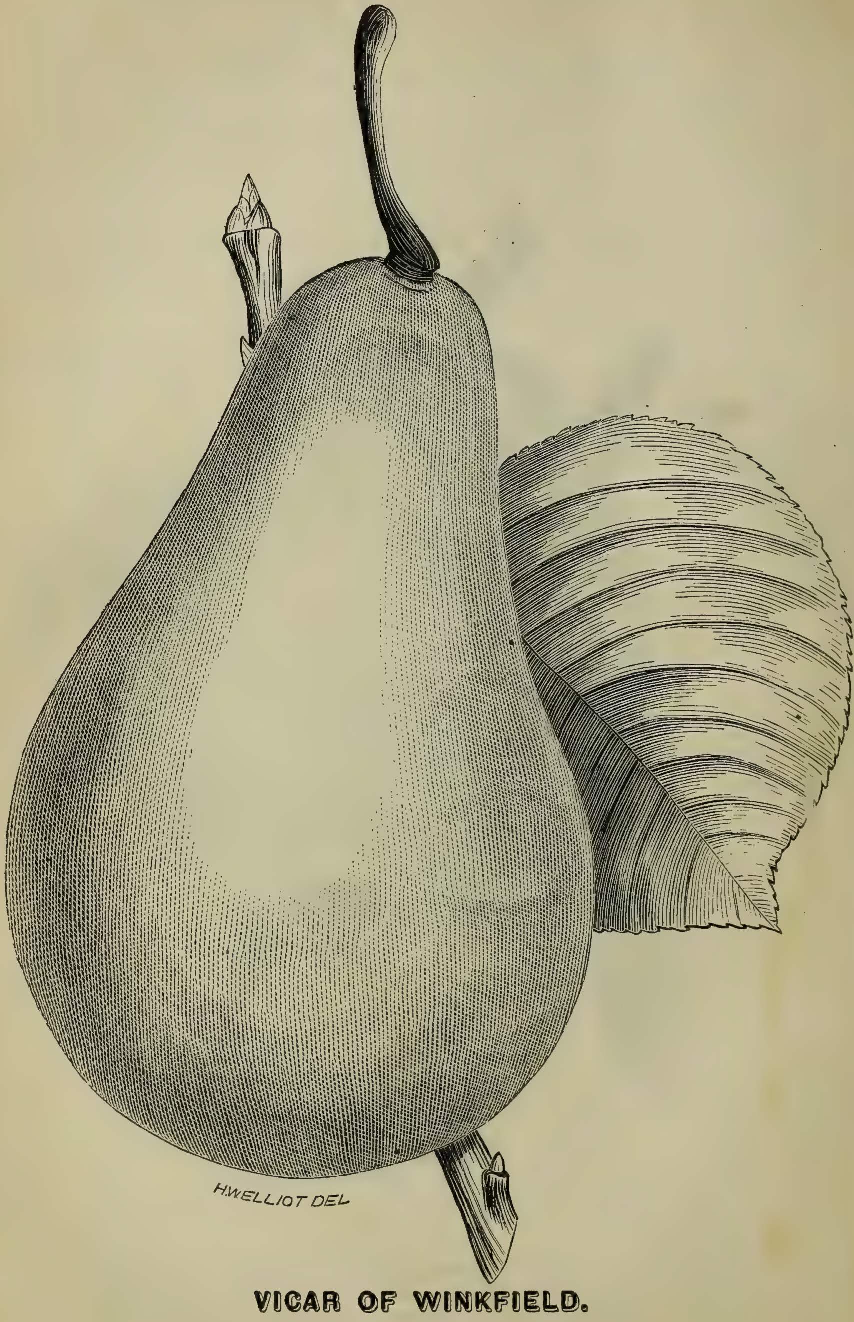
URBANISTE.—(Plate 25.)

LOUISE D'ORLEANS—ST. MARC—BEURRÉ PICQUERY—BEURRÉ DE ROI.

FRUIT.—*Size,* medium to large; *form,* obovate, obtuse pyriform; *color,* pale yellow, with gray dots and a few russet streaks, often slightly tinged with red in the sun; *stem,* three-quarters of an inch long, stout, thick; *cavity,* shallow; *calyx,* large, generally closed; *basin,* narrow, abrupt; *core,* medium; *seeds,* obovate, pointed; *flesh,* white, sugary, melting, vinous; *season,* late autumn. The Urbaniste is a Flemish variety. The tree is a healthy, vigorous, though slender grower, with numerous lateral branches; it does not come early

URBANISTE.

Plate XXVI.

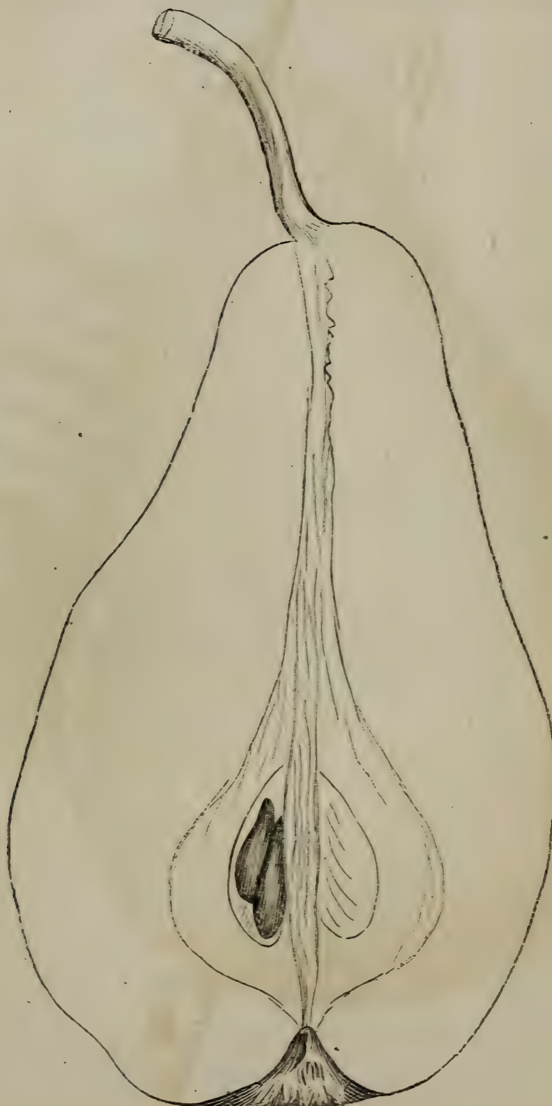


VICAR OF WINKFIELD.

into bearing on the pear root, but upon the quince root it forms one of the handsomest of pyramidal trees, producing immense crops of fruit. *Wood,* light brownish olive, with whitish dots, short jointed; *leaves,* medium size, thick, slightly folded, yellowish green.

VICAR OF WINKFIELD.—(Plate 26.)

LE CURÉ—MONSIEUR LE CURÉ—CLION—DUMAS—BELLE D'BERRY—PATER NOTTE—BURGERMIESTER.



FRUIT.—*Size,* large; *form,* oblong obovate, pyriform; *color,* dull, pale green at first, becoming pale yellow, and, when well grown, a brownish red cheek marked with brown dots over the whole surface; *calyx,* with open, reflexed segments; *basin,* very shallow; *stem,* an inch or more long, generally slender, swollen and fleshy at base; *core,* small; *seeds,* oblong, ovate; *flesh,* white, melting, juicy; *season,* winter. *Wood,* dark olive color; stout, annual

shoots, irregular, spreading in growth; large, roundish, glossy leaves. This is an old French sort that, while it fruits early upon the pear root, does not perfect its fruit until the tree acquires age; but upon the quince stock it thrives admirably, and produces, while quite young, immense crops of large and handsome fruit, that while it is not of first quality as a table fruit, is excellent for baking; keeps well and often excellent for dessert. It is a profitable sort, when grown on quince root, for orchard or garden.

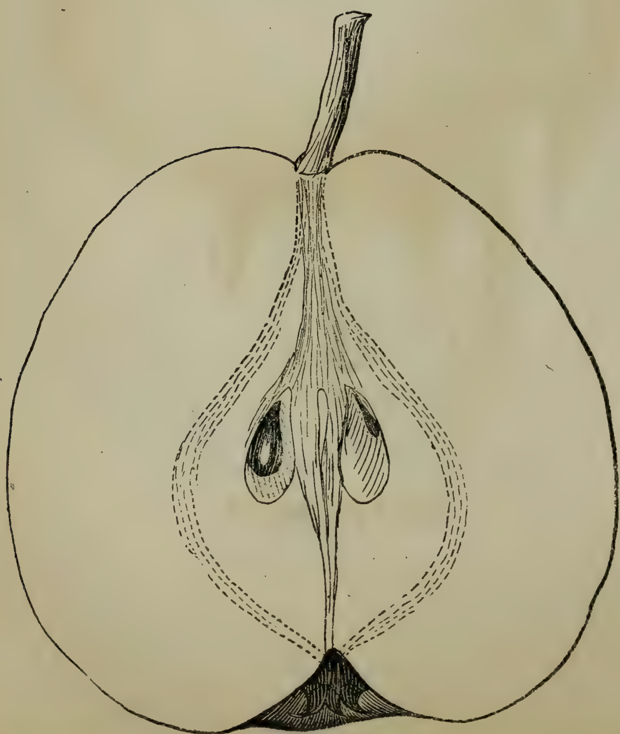
WINTER NELIS.—(Plate 27.)

NELIS D'HIVER—BEURRÉ DE MALINES—LA BONNE MALINOISE—MILANAISE CURVELIER—ETOURNEAU.

FRUIT.—*Size,* medium; *form,* roundish, obovate, narrowing towards the stalk; *color,* yellowish green, much covered and dotted with gray russet; *stem,* rather long, a little curved; *cavity,* narrow; *calyx,* open, with short segments; *basin,* shallow; *core,* medium; *seeds,* oblong, pyriform, curved; *flesh,* yellowish white, buttery, sugary, melting, aromatic; *season,* early winter. *Young wood,* slender, short jointed, dark brownish yellow, gray russet specks; *leaves,* medium, long, narrow folded. The Winter Nelis is a pear of foreign origin, but of such superior quality at its period of ripening as to require its presence in every good collection. The tree is vigorous, healthy, and very hardy, but quite irregular in its habit, requiring considerable care in forming its early growth. It apparently adapts itself to all soils, and comes early into bearing as a standard on its own stock. It is late in leafing out in spring.

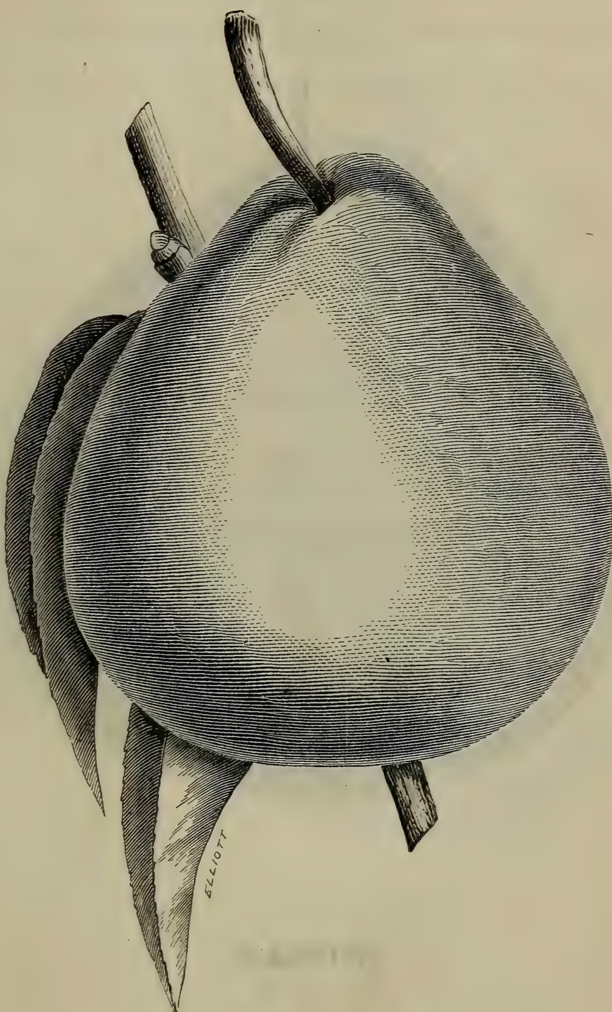
SECTION NO. 2.—*Varieties not generally known but that in the opinion of practical growers, are of good quality and profitable.*

MERRIAM.—(Plate 28.)



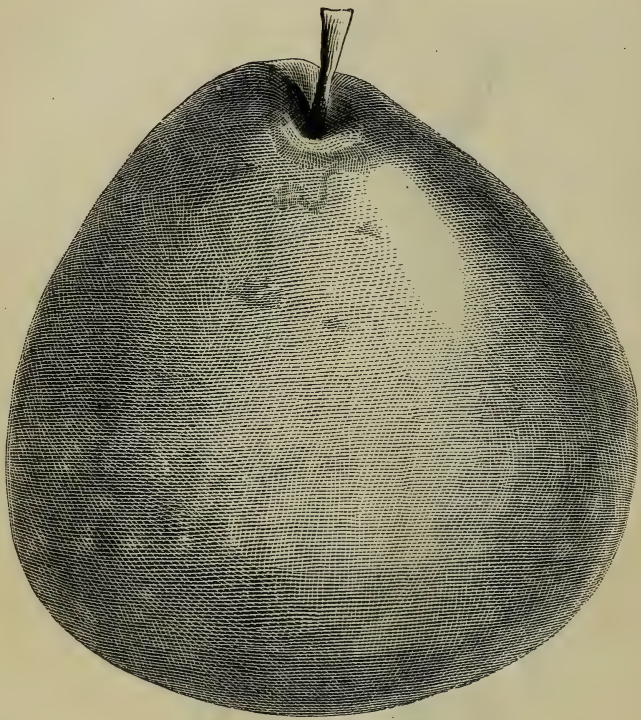
FRUIT.—*Size,* large; *form,* roundish, one side largest; *color,* dull yellow, mostly covered with smooth, pale russet, bronzed in the sun; *stem,* short;

Plate XXVII.

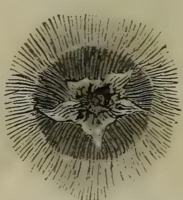


WINTER NELIS.

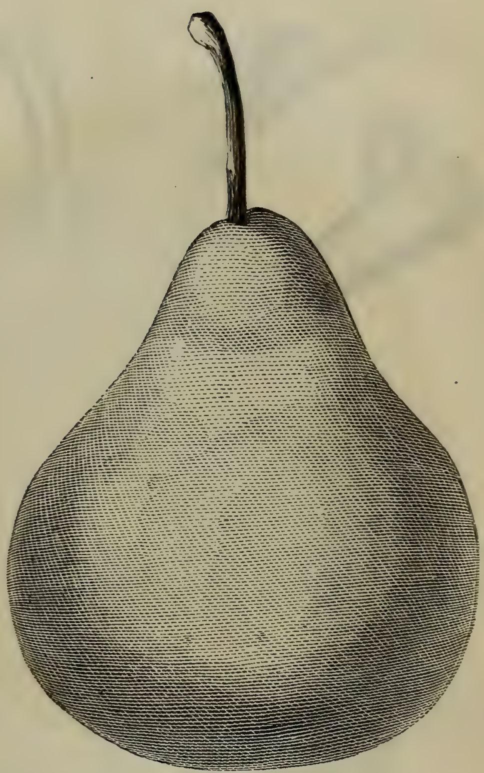
PLATE XXVIII.



MERRIAM.



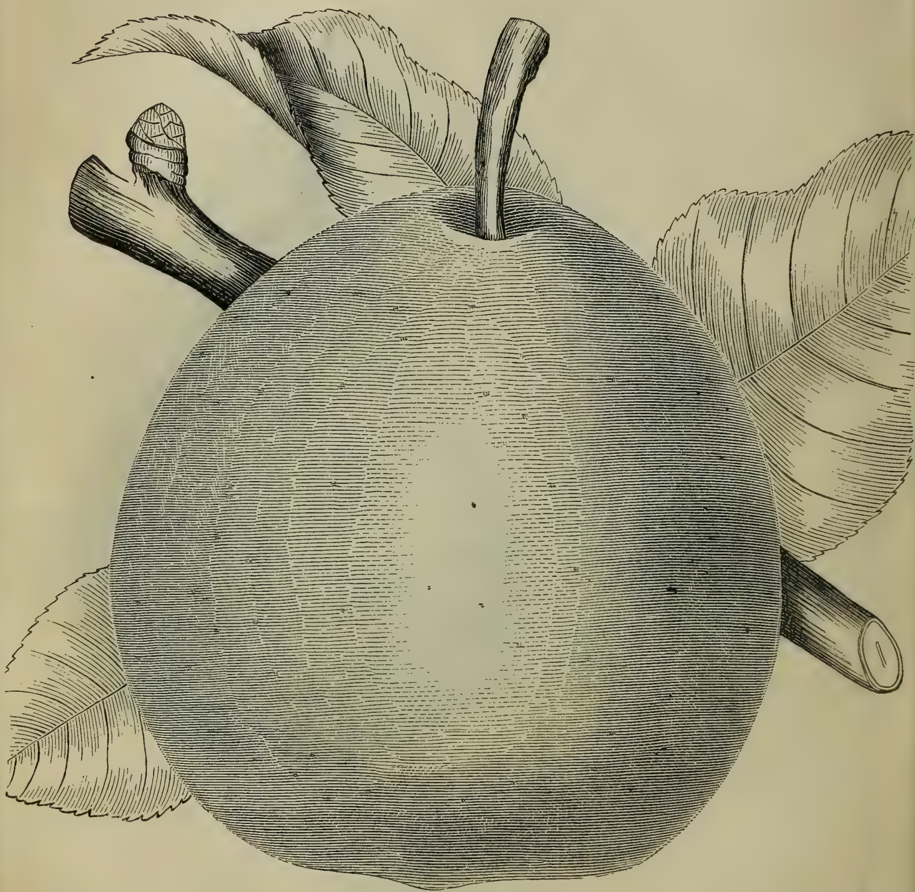
Calyx



H.W. ELLIOT DEL

LYCURGUS.

PLATE XXX.



SHELDON.

cavity, narrow, acute; *calyx*, large, with five open, separated segments; *basin*, broad, even, of moderate depth; *core*, apparently large but eatable, even to the capsules, which are large and open; *seeds*, ovate, pointed; *flesh*, white, rather coarse-grained, granular around the core, juicy, melting, sweet, slightly vinous; *season*, midautumn. The Merriam originated in Roxbury, Massachusetts. The tree is a vigorous, upright, healthy grower, coming early into bearing and producing crops of regular, even-sized fruit that commands a ready sale and good price. It is valuable as a market sort.

Lycurgus.—(Plate 29.)

Fruit.—*Size*, medium or below; *form*, oblong pyriform to oblong obovate pyriform; *color*, rich dull yellow, and overspread with brownish yellow russet; *stem*, usually three-fourths of an inch long, slender set, without depression, but with a slight lip on one side; *calyx*, large, in proportion to the size of the fruit, open; *segments*, connected; *basin*, shallow; *core*, compact; *seeds*, large, filling the capsule; *flesh*, yellowish, crisp, melting, juicy, sweet, spicy, sprightly, slightly vinous; *season*, winter. The Lycurgus is a native pear, originating at Cleveland, Ohio. The tree is a healthy, moderate grower, with brownish red wood, fine close-grained, upright, spreading, and very productive. The fruit, like that of the Seckel, is too small to attract attention as a market sort, but its excellence makes it very desirable as a dessert sort.

Sheldon.—(Plate 30.)

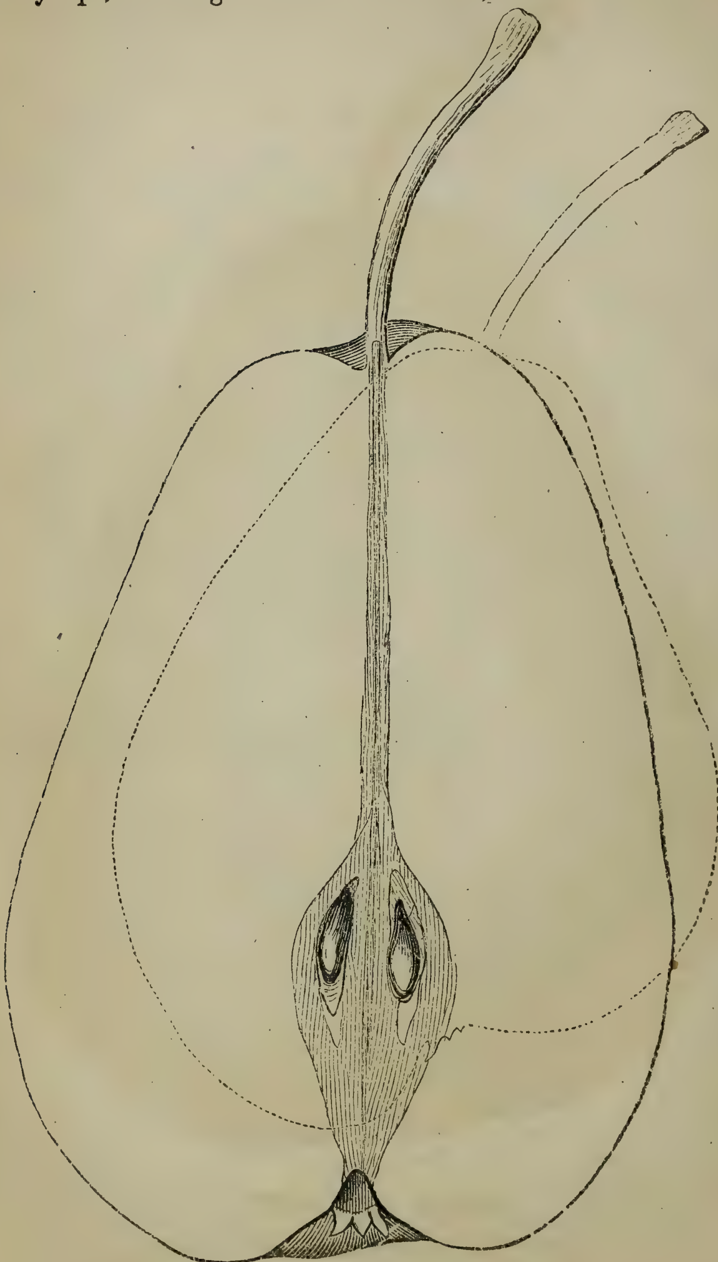
PENFIELD—WAYNE.

Fruit.—*Size*, medium or above; *form*, roundish, a little angular, sometimes obovate; *color*, pale greenish russet, light bronzed red in sun, and a little specked with dark russet; *stem*, short, rather stout, slightly curved; *calyx*, medium, open; broad, short segments; *core*, rather large; *seeds*, dark brown; *flesh*, a little coarse and gritty at core; otherwise juicy, sugary, sprightly, aromatic; *season*, autumn. The Sheldon comes into notice as a native variety from the town of Penfield, in western New York, but its exact origin is a little in doubt. The trees are vigorous and tolerably upright growers, coming early to maturity and producing abundant crops on the pear root.

SECTION No. 3.—*New varieties that give promise of qualities that will hereafter render them worthy of general cultivation.*

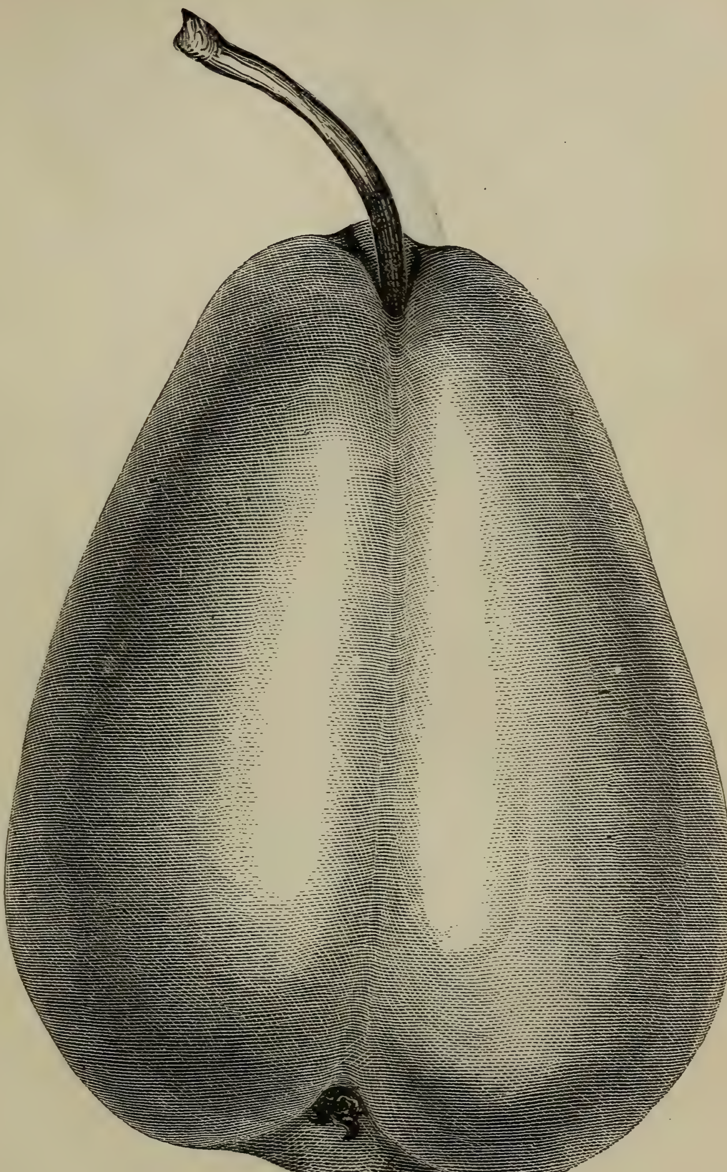
BELLE WILLIAMS.—(Plate 31.)

FRUIT.—*Size,* large to very large; *form,* oblong obovate pyriform; *surface,* somewhat rough; *color,* dull, dark greenish, becoming tinged with yellow, when fully ripe, marblings and traces of russet, and russet often around the



stem; broad suture on one side, extending from stem to calyx; *stem,* long, slender, set without depression; *calyx,* medium, open, with stiff, coarse segments; *basin,* open, broad; *core,* small; *seeds,* few, plump, light brown; *flesh,* white, crisp, until fully ripe, when it becomes almost melting; juicy, vinous; *season,* winter. An English variety.

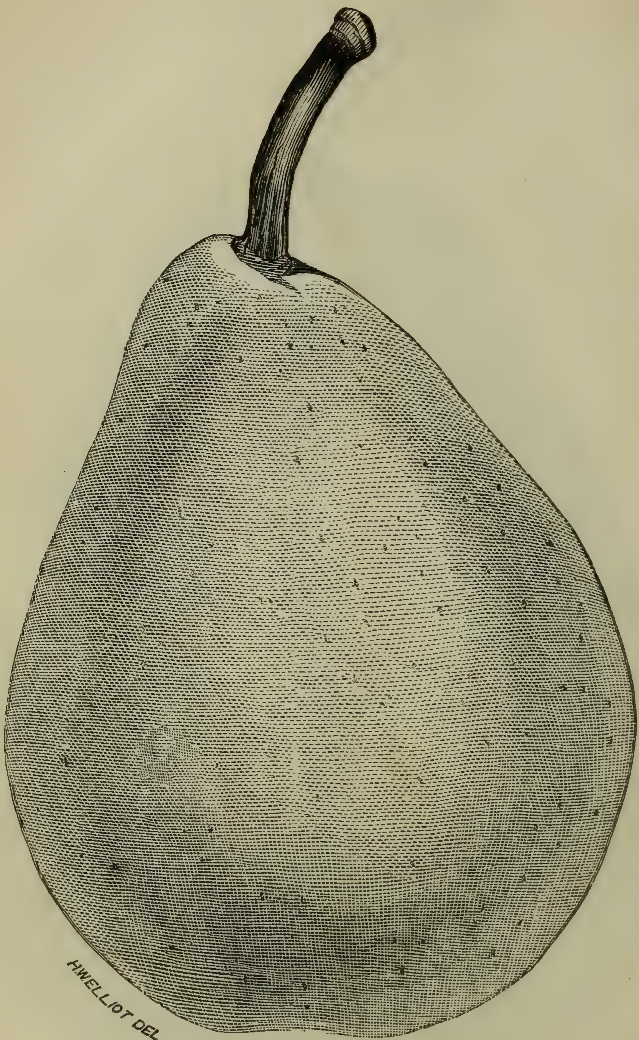
PLATE XXXI.



H W ELLIOT DEL

BELLE WILLIAMS.

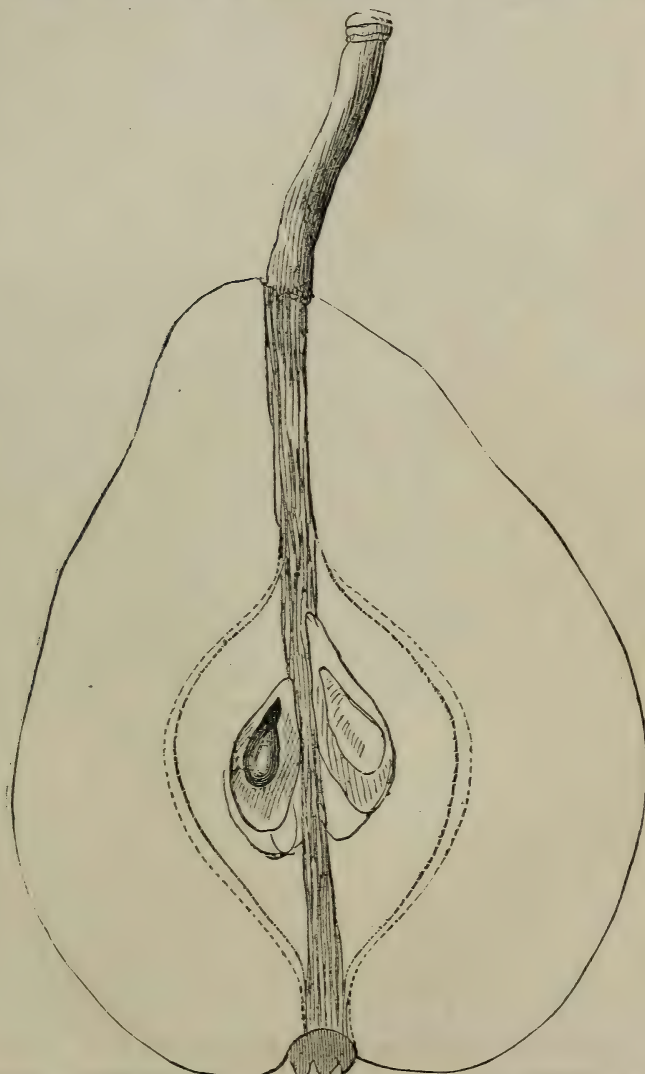
PLATE XXXII.



CLAPP'S FAVORITE.

CLAPP'S FAVORITE.—(Plate 32.)

FRUIT.—*Size,* large; *form,* obovate, oblong pyriform; *surface,* smooth in some specimens; in others, uneven; *color,* clear light yellow, with a beautiful red on side exposed to the sun; the red is in form of small specks running together where they most prevail, and becoming wider and fainter as they spread out over and around the fruit; *stem,* moderately stout, one and a half inches long, set with rarely any indications of depression, but with a slight knob or lip on one side; *calyx,* open, with short, stiff segments nearly erect; *basin,* shallow, slightly corrugated or furrowed; *core,* with long thready fibres that



melt and decay in the mouth; *capsules,* long, ovate; *seeds,* few, partly imperfect; the perfect ones medium size, dark brown; *flesh,* nearly clear white, buttery, melting, sugary, vinous; *season,* late summer. This beautiful new variety was supposed to be grown from seed from a cross of the Bartlett and Flemish Beauty pear, by Mr. Thaddeus Clapp, of Dorchester, Massachusetts. It has been classed by the American Pomological Society's fruit committee as "best" The tree is vigorous, with a broad, thick, dark green leaf, with dark, reddish wood, of close grain, giving promise of great hardihood. The fruit has all the excellent qualities of the Bartlett without its musky taste, so unpleasant to some persons.

CLIMATOLOGY OF AMERICAN GRAPE VINES.

BY JAMES S. LIPPINCOTT, HADDONFIELD, NEW JERSEY.

THE recent introduction of numerous varieties of native American grapes, and the creation of several hybrids between the indigenous, hardy species of our woods and the best foreign kinds, have afresh excited an interest in grape culture in the United States. Formerly the *vitis vinifera*, or wine grape of Europe, with few exceptions, had been esteemed the only variety worthy of cultivation for the production of wine, and few, very few, indeed, of American origin, could, by a cultivated taste, be considered fit for the table.

The wine grape is not a native of Europe, but has followed the footsteps of man from the shores of the Caspian sea, and "intertwined its tendrils with civilization and refinement in every age."

The forests of Armenia, at the base of the Caucasus and the South Caspian region still exhibit it in its original condition, climbing the highest trees, and producing a small and hardly palatable fruit.* At the present day wine is pressed from the wild grape on the banks of the Orontes.

From its extensive and long continued cultivation, it is not surprising that a multitude of varieties have been produced. So numerous are they, and so dissimilar in properties and adaptation to various climates, that it may well be questioned whether they have all been derived from the *vitis vinifera*, or have not, rather, sprung from several species by accidental crossing. If we believe, with Darwin, that species are indefinable, and that those now existing have originated from a few primordinal forms; that variations are unlimited, and that through the struggle for existence, and the principle of natural selection, individuals have been led to choose the conditions best adapted to their preservation and the perpetuity of their offspring, we may suppose that through the centuries elapsed since man found the wild vine, these influences, combined with his efforts at improvement, have produced from one original form the hundreds that now exist. The tendency to vary has long been observed by horticulturists, and turned to valuable practical purposes.

This disposition is by no means universal; for while some kinds of plants will produce a multitude of varieties when raised from seed, and are susceptible of almost unlimited degrees of improvement, others of nearly similar nature are almost incapable of variation. Of the apple and the pear, the varieties are innumerable; while of the hawthorn, of which millions have been raised from the seed, there exist not more than half a dozen marked varieties. The crab, from which all our apples originated, is wild in most parts of Europe. The almond tree so strongly resembles the peach tree that it is difficult to distinguish them by their leaves and wood only; indeed, several botanists are of the opinion, from experiments made in raising the almond from seed, that they were originally the same, and that the rich and luscious peach is the result of accidental variation produced by culture upon the almond.

These illustrations of the tendency to change and the possibility of producing many and widely differing kinds, furnished by the vine, the apple, and the peach, encourage the belief that the efforts of American pomologists to create new varieties of grapes, adapted to our climate, soil, &c., are in the right direction. For, if from the small, austere crab has sprung that prince of apples,

* Unger on plants used for food.

the Newtown pippin, and from the wild vine of America, with its scarcely palatable berries, have arisen the noble Hamburgh, the delicious Chasselas and Muscats, and the hard, dry shell of the almond has been by culture taught to swell with honeyed juices, until it rivals the mangosteen of India, and the cherimoya of Peru—fruits unsurpassed by any others vouchsafed by the Creator to man—what may we not expect from the operation of similar causes when brought to bear, if they are not already at work, upon our indigenous vines, of which we can boast of at least ten well-defined species? Already we believe we perceive the effect of these influences in the multitude of seedling native grapes, which exhibit greater or less departure from the normal condition and properties of their assumed parents. Though many of these varieties cannot properly be called improvements on the native kinds as they exist in our woods and by our watercourses, yet we have already secured several that undoubtedly are, and will continue to be highly esteemed.

Having formed to our hands species which the fostering and curbing care of nature has through ages fitted to endure the great extremes of heat and cold of our northern States, we start upon the cultivation of the vine with materials adapted to our varied needs. From among the new varieties clamoring for attention, and whose claims to notice are in several instances worthy of especial regard, it behooves the pomologist to separate with unsparing hand, not alone the worthless, but also those of slight merit. Where so many are found worthy of esteem for sundry good qualities, or adapted to certain soils, localities, climatic influences, and modes of cultivation, the importance of full and correct information on these particulars becomes plainly apparent. A judicious choice of plants adapted to our zones of climate is of the first importance. This branch of the subject of vine culture has not received in America the attention its importance seems to demand.

THE WINE GRAPE IN THE UNITED STATES.

Those unacquainted with the history of vine culture in America will perhaps inquire, Why has not the European wine grape, with its countless varieties growing in regions extending from the Tropic of Cancer to the Baltic sea, and, of course, endowed with various degrees of hardihood, been generally introduced into the United States and successfully cultivated? To this question we may reply, that every species of plant requires a definite amount of heat for its proper growth, though this may vary in intensity, and a comparatively low degree may be compensated by its longer continuance.

There are certain limits to this rule, for if the temperature rises above a given degree, or falls below a particular point, the vitality of the plant may be destroyed. Thus, besides the mean temperature, the extremes are of essential importance in determining the variations to which the plants may be subjected without injury. The length of the growing season, or the interval which occurs between two killing frosts, is of great importance.

The degree of moisture or dryness is of essential value in judging of the productiveness of different years and of different places.

The extreme northern limit beyond which the wine grape will not ripen has been definitely ascertained.* In western Europe this line may be traced from the Atlantic ocean, in latitude 47½°, to nearly 50° on the meridian of Paris, entering Belgium by the valley of the Maas. Returning south to the parallel of 50° thereon to the Rhine, it descends this river nearly to Cologne; and reascending to the Mayne, passes through Frankfort, and by the valley of the Mayne to Saxony, thence to Berlin, and from this city east by south through Russia to the Caspian sea.

* Peterman's Physical Atlas, and Schouwr's Earth, Plants, and Man.

These limits cannot be considered the boundary of the best wine districts, which would be found at least 1½° further south, and might more properly be traced through Bordeaux, central France, where not too elevated, to Manheim, and by the valley of the Danube to the Black sea. In favorable years, grapes may ripen even on the borders of the Baltic sea, at Koenigsburg. From the Caspian sea, the northern limit of the vine may be defined with approximate accuracy as passing through northern Persia, Cabool, northern India, Thibet, and China. Along some parts of this line it is cultivated only in sheltered valleys among the highlands and plateaus of central Asia.

The cultivation of the wine grape is prosecuted in the narrow, sheltered valleys of northern France, and on the terraced hills of the Rhine, while the greater part of the interior of both France and Germany, extending south from Frankfort on the Mayne, is too cold to ripen its fruit. This is ascribed to the fact that the interior of these countries rises to plateaus of considerable elevation, and the reduction of the mean temperature is equivalent to several degrees of higher latitude. All these favoring and unfavorable influences have their counterparts in America, with minor modifications, as we shall perceive in the course of this article.

Within the limits favorable to the growth of the wine grape in Europe, the climatic peculiarities may be considered as regular and permanent in their recurrence through successive years. No wide departures from the average of mean winter or summer temperature occur. This is made evident by the long continued cultivation of the vine upon the borders of its range, where a slight reduction of temperature, or diminution of humidity in the atmosphere would be destructive to the plant. The possibilities of culture are thus clearly defined, and observations continued through many years have demonstrated* that at those localities where the summer temperature falls below 67° Fahrenheit, the wine grape will not ripen its fruit so as to produce wine of any valuable quality.

The mean annual temperature, as has been remarked, is not a guide whereby to judge of the adaptation of a locality to the production of grapes fitted for wine, for the high heats of summer may be set off against the severe cold of winter, and the mean thereby be found to be the same as that of places not subject to either extremes. A summer mean, or rather the mean for the season of growth, is generally, though not always, a certain measure of fitness, and the mean temperature of 65° is defined as the lowest that will permit the vine to ripen.

If we attempt to apply the experience of the wine-growers of Europe to the cultivation of the wine grape in the United States east of the Mississippi, we are met with difficulties resulting from extreme variations in temperature, rain, and atmospheric humidity, unknown to the same extent in wine-growing countries. Here the extremes of atmospheric humidity and dryness are often positively injurious, and our drenching rains and parching droughts, often destructive to the fruit after it has passed the ordeal of varying temperature, to which it is at all times and at all places more or less exposed. The constitution of the wine grape is not fitted to withstand these sudden changes from extreme humidity to extreme dryness, and the plant and its fruit rapidly deteriorate in our uncongenial air. To these causes may be ascribed the prevalence of "mildew" and "rot," the almost universal attendants of foreign wine culture in the United States, and which no skill can obviate, and from which no section has been found claiming exemption.

The variable nature of our winters on the disputed ground of heat and cold between the latitudes of 38° and 42° offers another impediment to the successful introduction of the foreign vine.

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* Boussingault's Rural Economy.

The writer is not without his share of experience, in common with hundreds who have entered upon the cultivation with high hopes, to find them ere long rudely crushed. The mild weather frequently occurring in February causes the sap to rise and the buds to swell; this is immediately followed by a killing frost, in some instances splitting the stem for several inches by the freezing of the sap, thus utterly destroying the vine and the hopes of the owner.

A century has passed since the earlier efforts to acclimate the wine grape of Europe, and we appear to be as far as ever from the object of our desire. Acclimation, in the true sense of the word, seems to be a chimera; at least, all attempts to acclimate this plant have proved failures.

Whether tried by Swiss, by German, or by native vine-dressers skilled in the treatment of the vine, all their efforts have been attended with similar results—disease, and the death of the plants after a few years.

In Pennsylvania, at Spring Mill, by Peter Legeaux, by the Swiss at Vevay, in Indiana, or by Lakanel in Ohio, Kentucky, Tennessee, and Alabama, all have alike failed; and though Berckmans may be yet sanguine as to success in the southern States, in the words of the lamented Downing, "the thing is impossible."

Had the past generation possessed that acquaintance with the fixed peculiarities of our climate (for, with all its variations, it is governed by definite laws) that we can now command, they would have been spared a vast expenditure of money, time and labor, fruitless anxiety, and disappointed hopes. Let us apply our newly-acquired knowledge of these laws, and prevent the recurrence of similar results. The only vineyards ever successful in America are those of American grapes. To these, then, we may turn with confidence.

In the northern States of North America, east of the Mississippi, there exist five well-marked varieties of vines termed species, because seemingly persistent in their native haunts.

All other species described or named, and said to be indigenous throughout this district, are believed by the more experienced botanists to be but varieties or forms of one or other of these five, viz:

1. *Vitis Labrusca,* of Linnæus—the northern fox grape.
2. *V. æstivalis,* of Michaux—the little grape, frost grape, summer grape of the botanists.
3. *V. cordifolia,* of Michaux—the chicken grape, winter grape.
4. *V. rotundifolia,* of Michaux—the Muscadine, bullace, or bull grape of the south. It is by some considered the *V. vulpina,* of Linnæus, or southern fox grape, though his description more nearly accords with that of *V. cordifolia.* It is not known as the fox grape in the southern States. A variety is the Scuppernong of North Carolina.
5. *V. Caribbæa,* of De Candolle. Its fruit resembles that of *V. æstivalis.*

These five species are not common to the States east of the Mississippi, but each has its range, beyond which, to the north at least, it will not flourish.

The *V. Labrusca* and *V. æstivalis* find their northern limit in Vermont, while they grow in greater or less abundance thence to Georgia, on both the eastern and western slopes of the Appalachian chain. *V. cordifolia* grows in all the States east of the Mississippi, and its range extends west to the Rocky Mountains, north to Lake Winnipeg, and south to Texas. It is the only indigenous grape in Wisconsin and Minnesota.

V. rotundifolia is rarely found north of Delaware and the low country of Maryland, and extends south to Florida. It more properly belongs to North Carolina.

V. Caribbæa grows only in the thickest swamps of Florida and Arkansas.

While the species found in the lower latitudes will not grow if removed further north because of the cold, the natives of higher latitudes, inured there-

to, will not endure the southern heat upon either the humid or dry soils of this region, both of which there abound.

We have the authority of Major Leconte that the Scuppernong cannot ripen perfectly north of Virginia, and the fox grape of the north will scarcely grow in the lower regions of Carolina and Georgia. The Isabella, originally brought from the upper districts of North Carolina, does not flourish in the low country, and will scarcely live in Georgia; and the Catawba, found on the banks of the Potomac, will not thrive in Texas.

THE ORIGIN OF THE NEW NATIVE VARIETIES.

From these five species, as before remarked, all the native varieties have originated.

The *V. Labrusca*, or northern fox grape, is doubtless the parent of all those producing large berries, whether purple, green, or amber colored. Most of them are natural products found by man, or seedlings which he has somewhat improved. Some may be hybrids, slightly influenced by a foreign intermixture, while others are decidedly mules, partaking of the nature of both parents. The Isabella and Catawba are varieties of the northern fox grape, differing only in the shorter pubescence of the under side of the leaves, the more numerous berries modified in shape, color, and quality. From it are also derived the Alexander or Schuylkill, N. Muscadine, Hartford Prolific, Concord, and a host of others of less value. Diana, Anna, &c., may be seedlings from the Catawba. From the Isabella again have originated many new kinds of various degrees of merit. This species, the *V. Labrusca*, is more sensitive in its wild state to injury from the causes that produce "mildew" and "rot," and its descendants exhibit the same tendency in common therewith.

From the summer grape *(V. æstivalis)* may have sprung several of the smaller fruited varieties, though it is probable that from the wide diversity in their hardihood, those more tender may have originated from a southern species not distinguished from that producing the more hardy kinds of the north.

Herbemont, Warren, Pauline, Lenoir, Norton's Virginia, and others, belong to a class all remarkable for their high flavor, and none of which will probably ripen their fruit north of New York unless in sheltered places, or endure the rigors of winter, even in that latitude, without protection.

In another class of vines, also small berried, but very hardy, we may place the Delaware,* Clinton, King, &c., all doubtless descended from the *V. æstivalis*, or summer grape.

To the above named we may and last but not least, Allen's Hybrids, produced in Boston by impregnating the pistils of the blossom of an Isabella with pollen from a variety of European grapes. The seeds produced from this cross have grown and borne fruit partaking of the Isabella flavor combined with the sugary wine of the Chasselas. The seedlings of Peter Raabé, of Philadelphia, have been deemed valuable in temperate localities. Some of them are accidental crosses between our native kinds, and others the produce of foreign seed. They are Brinklé, Clara, Emily, and Raabe. More recently much interest has been excited by the appearance of Rogers's Hybrids, the result of crossing, as related above in the case of Allen's Hybrids, the largest varieties of the northern fox grape with the Black Hamburg and Chasselas, thus producing several kinds of great promise, both for size, flavor, beauty, early ripening, and hardihood. The success attending these experiments in

* Respecting the origin of the Delaware grape much uncertainty exists; it must, however, be considered a native. J. N. Sheppard, of Marion, Ohio, states in the Country Gentleman, vol. xviii, p. 319, that out of 1,000 seedlings from Catawba seed, he produced some showing dark colored fruit resembling Isabella, and one bearing fruit, leaf, wood, and in habit of growth, not to be distinguished from the "Delaware.'

hybridizing has opened a new era in grape culture in this country. Having shown wherein the difficulties in the way of the successful culture of the foreign vine consist, and that we possess several species from which varieties and sub-varieties have been derived, many of them of high merit and different degrees of hardihood, it remains to designate the kinds fitted for culture in the several zones of our varying climate, and to indicate their boundaries as clearly as is consistent with the extent of our information and the narrow limits assigned to this paper. Pomological conventions have dwelt upon the importance of a choice of fruit adapted to certain localities, but their deductions appear to have been made from empirical data—the opinions merely of growers who have tried some kinds, and who may have had no experience with others perhaps quite as well fitted to succeed. We want information respecting our various fruit regions based upon positive knowledge of the climatic peculiarities of these districts, combined with the concentrated light from hundreds of experimentalists in every section. The importance of definite knowledge of the fitness of certain varieties of vines for certain regions is apparent to all who have for many years failed to produce fruit in northern latitudes from plants which they have trained, pruned, and nursed with tender care and hopefulness, to find, at last, that they had started wrong, and all their efforts futile.

Marshall P. Wilder, president of the American Pomological Convention, stated that "he had not had a ripe Isabella in his garden, near Boston, for twenty years;" and C. M. Hovey "had never picked the Isabella ripe enough in twenty-four years." T. B. Miner asserts "that the Catawba does not ripen in northeastern or central New York more than one season in ten."

We have the assertion of P. Barry, of Rochester, that the Catawba will not ripen in this latitude, and from the Transactions of the Ohio Pomological Society we draw the statement that "it is only in most favorable seasons that the Catawba attains perfection even in Cincinnati."

The vagueness with which reference is often made to the climate of large districts as adapted to certain kinds of vines, is conclusive evidence of the want of intimate acquaintance with the peculiarities of those regions. We have seen the expression that "the Lenoir is hardy in New England," conveying the idea that New England is everywhere fitted to mature this grape, and that the cold of winter does not there affect it. Now, New England is not a small locality, whose climate may be described in a few words, or pronounced, *ex cathedra,* as fitted throughout for the home of any one variety of the vine. New England is a large territory, extending through more than six degrees of latitude, from mild and equable Nantucket on the south, to the mountains of Maine and Canada, including those of New Hampshire, where snow is never absent, and where the mean for the year is but ten degrees above freezing, and an entire day has been known to experience a temperature thirty degrees below zero, and a minimum indicated of forty degrees below that point, suggestive of hyperborean cold. Again, some points in high latitudes in Vermont enjoy a thermometric range of 132° degrees, rising to 100° in summer to sink to 24° in winter in one instance, and in another rising to 92° to sink to 40° below zero.

Surely at Rupert or St. Johnsbury, where the mercury takes so wide a range, we need not, with the poet, call upon imagination for—

> "The bitter change
> Of fierce extremes—extremes by change more fierce
> From beds of raging fire to starve in ice."
> * * * * * * *

Without, at present, inquiring into the causes that render localities in eastern America, in latitudes corresponding to the vine regions of Europe, much colder in winter, while they are warmer in summer, and the existence of a mean annual temperature on the Atlantic coast of 8° to 10° below that of places in

western Europe at the same distance from the equator, we will proceed to indicate the northern limits of the districts which we have denominated grape zones, and to designate the varieties adapted to each.

THE GRAPE ISOTHERMS AND GRAPE ZONES OF THE NORTHERN STATES.

The results of "Meteorological Observations," made at numerous stations over an extensive region of the northern and western States from the year 1854 to 1859, inclusive, and recently published by the Patent Office, have added greatly to our knowledge respecting the mean temperature of this region, and furnished us with data not hitherto accessible.

For the meteorological facts on which our lines of equal heat have been based, we have been largely indebted to the above named "Results," &c.

We have therefrom laboriously reduced the means for several hundred points, necessary to our purpose, from Maine to Missouri, compared them with the reports of observations made at several United States military posts, as tabulated in Blodget's valuable "Climatology of the United States," and with those made under the direction of the regents of the university at sixty-two academies in the State of New York during twenty-five years.

Our insight into the distribution of heat in the atmosphere may be rendered more clear by connecting together by lines those places having the same mean, summer mean, winter or mean annual temperatures, respectively. These lines are termed isothermal lines, or lines of equal temperature, and have been traced around the earth with more or less precision, according as observations have been made more or less remote from each other, and with greater or less accuracy. These lines afford important guides to the localities where the cultivation of certain plants and fruits may be successfully conducted, for plants are, in general, confined to certain regions of the earth where the circumstances of temperature, moisture, &c., are found most conducive to their healthy growth. Isothermal lines have been delineated upon maps, &c., indicating the limits of the districts where the olive, the vine, wheat, Indian corn, cotton, rice, and many other plants thrive most freely.

The definition of zones, torrid, temperate, &c., which has long been in vogue, has really no place in nature, and the actual measures of heat alone constitute the various belts of climate.

The vine is peculiarly the growth of definite climatic conditions, and its zone has been pretty accurately defined.

The tortuous line bounding the European region of vine growth on the north, winding through the valleys of northern France and Germany, now ascending on one side to descend on the other, curving round the base of the hills, or climbing on terraces their sunny slopes, instinctively follows the isotherm of mean temperature of the season during which the grape is forming and maturing its fruit.

The American grape appears to ripen under nearly the same mean temperature as that of the wine grape, or to be limited in its range on the north by the same climatic peculiarities; but no attempt has been made, that I am aware, to minutely define the limit in the United States, nor has attention been paid to the fact that certain classes of grapes are adapted to definite *belts* of region in our country.

The lines bounding our grape regions have not been laid down theoretically, based upon certain mean temperatures, without reference to the observation and experience of growers. Extensive notes of their reports and opinions have been tabulated and digested. The mean temperatures for June, July, August, and September, at most of the points where grape-growing has been attempted, have been noted upon the map of the United States, and lines drawn passing through all those points, at which a similar, or nearly a similar,

mean was found to exist. Thus connected by these isothermal lines, the grape zones have been developed.

The* isothermal mean of 65° Fahrenheit, for the four months of June, July, August, and September in North America, has its extreme limit in the valley of the Penobscot, near its mouth. Tracing it thence southwest, we find it skirting the coast of Maine by Gardiner and Saco, and entering New Hampshire below Great Falls. Thence curving westward, it passes below Concord, New Hampshire, and northwest to the valley of the Connecticut, at Windsor, Vermont, and perhaps further north. The valley of the Upper Connecticut joins too high latitude with too great elevation to permit the continuation of this isotherm northward, but it again appears in the low-lying valley of the St. Lawrence, nearly as far north as Quebec. In this high latitude the minimum of 44° below zero has been observed, as at St. Martin's, Canada East, in 1859, a degree of cold which would perhaps prove destructive to the hardiest native vines if unprotected. It has been already observed that the range of our native species, with one exception, does not extend further north than the northern boundary of Vermont. From Quebec, the isotherm of 65° may be traced up the valley of the St. Lawrence, and entering New York, it passes near Potsdam, east of Governeur and west of Lowville, near to Houseville, and ranges by the base of the mountains of northern New York, through Herkimer, Hamilton, and Warren counties, skirting the west shore of Lake Champlain, to the St. Lawrence; thus encompassing the highlands of this region, in whose valleys the grape will not ripen. It perhaps passes through Lake Ontario from east to west, crosses the peninsula to the foot of Lake Huron, across Michigan to Green Bay, and thence, in the same northwest direction, to the Mississippi.

The eastern coast of New Hampshire and northeastern of Massachusetts, north of Boston, the higher regions of the interior of Vermont, and of Massachusetts, in the counties of Worcester, Hampshire, Hampden, and Berkshire, and the higher lands of Connecticut, generally are found to have a mean temperature of 65° for the four months named, and it is only in favored localities in these regions that the hardiest vines will ripen.

The isotherm of 65° again appears in southern and middle New York, south of the valley of the Mohawk and west of the valley of the Hudson and in the northern plateaus of Pennsylvania, along the mountain ranges of the interior of the latter State and of Virginia, skirting their valleys at a high elevation almost to the parallel of 38°.

The isotherm of 67° for the four months before named, appears first at Saco, Maine, and again at Manchester, New Hampshire, and thence in the valley of the Merrimac nearly to its mouth. From Manchester it ranges southeast, curving through Cambridge, Boston, and Bridgewater, to Nantucket.

From Manchester, New Hampshire, it also ranges southwest through Worcester, to Springfield, and a short distance up the valley of the Connecticut. Again it curves southwest from Cambridge, through Mendon, north of Providence, Rhode Island, to Norwich, Connecticut, by the coast of Long Island sound to the valley of the Hudson, whose sides it skirts at a small elevation, and also that of Lake Champlain, almost, if not quite, to Montreal. From Montreal, we find it in the lowlands bordering the St. Lawrence, near the eastern and the southern borders of Lake Ontario and Lake Erie, in the region of the smaller lakes of western New York, and in the valley of the Mohawk.

It thus encompasses the region bounded by the line of 65° at lower levels in the northeast part of the State. At the east end of Lake Erie it recedes to a greater distance from the lake, and includes much of the elevated region

* The lowest summer temperature permitting the vine to succeed in Europe is 65°, and a summer below 67° will not produce wine of any valuable quality or quantity."—*Boussingault's Rural Economy.*

lying between it and the Alleghany river, at least as far south as Worthington, latitude 41°, whence it may be traced west-northwest through the counties of Butler and Beaver, in Pennsylvania, and of Trumbull, Portage, and Cuyahoga, to within a few miles of Cleveland, in Ohio; reappears on the northern shore of Lake Erie, near Detroit, thence passing across Lake Michigan and Wisconsin, north of Madison, to the Mississippi, at the southeast corner of Minnesota. It also skirts the eastern side of the Alleghany mountains, through Pennsylvania, from the northeast corner of the State to the west border of Maryland.

The isotherm of 70° first appears at the east end of Long Island, and may be traced northwestwardly to West Point, thence westwardly to Shawangunk mountains, at the northern extremity of New Jersey, and southwest along the foot of their prolongation, the Blue mountains of Pennsylvania, and valley of Lehigh, Lebanon, and Cumberland, Pennsylvania, Winchester, Virginia, to Lewisburg, latitude 38°; thence curving northwest and north, it reaches the Ohio, below Steubenville. From this point it extends northward across the State of Ohio, through Oberlin, and in the same direction through the southern tier of counties in Michigan to Lake Huron, through the northeast corner of Illinois, the lower counties of Wisconsin, to the Mississippi, near Prairie du Chien. An out-lying region where the mean of 70° occurs, exists on the southern border of Lake Erie, from near Fredonia, New York, to Sandusky, Ohio.

It only remains to trace the isotherm of 72° for the four months indicated. This may be said to commence at a point on the shore of New Jersey, near latitude 40°; thence extends across the State, through Philadelphia, northern Delaware, to Baltimore and Washington; thence southwest through Virginia, parallel to the line of 70°, to be broken by the mountains in the southern part of the State, and returning north on the western slope of the Alleghanies, near their base, to Marietta and Zanesville, Ohio, it is deflected southwest by the highlands, to the Ohio river, at Portsmouth, and crosses into Kentucky; thence it passes northwestward above Cincinnati, through central Indiana and Illinois, to the Mississippi, which it crosses south of latitude 40°.

An isotherm of 75° might be traced nearly parallel to that of 72°, in lower Delaware, Maryland and southeast Virginia, extending through the middle counties of Kentucky, southwest corner of Indiana, and south Illinois.

Below this line, perhaps, it will be found that the most tender varieties of the fourth class ought properly to be placed.

There are some exceptions to the application of these laws in higher latitudes and in the States bordering on the Mississippi.

The sudden reduction of temperature in September, unless the first half retains the high degree of August, may not permit even the earliest and hardiest kinds to perfect their fruit. This is the case in the latitude of Montreal. Here, though the summer mean taken alone would seem to indicate a very high temperature, that of September is not generally adequate to the maturation of the grape.

Wherever, as in the higher latitudes or on high altitudes, the shorter season of summer heat prevents perfect maturation, all means that promise to hasten the ripening of both fruit and wood should be resorted to. Late growths should be especially guarded against, by removing the extremities of the shoots in September, thus concentrating the energies of the vines upon the lower buds.

A warm, well-drained soil, free from excess of vegetable matter or animal enrichment of any kind, is of quite as much importance, aiding materially the ripening process and preparing for the coming cold. The high fertilizing with clammy, mucky composts, rendering the soil retentive of moisture, and therefore colder, is one cause of the many failures in grape-growing in the northern regions of the vine.

In southern Wisconsin and northern Illinois, where the grape isotherm of seventy degrees occurs, and in middle Illinois and Missouri, where that of seventy-two appears, the mercury has fallen in winter to twenty-three degrees

below zero. This is a point very rarely if ever reached on the same line in the east, and would assuredly destroy the vines adapted in the Atlantic States to these isotherms. At Philadelphia, on the line of 72°, the mercury did not fall lower than five degrees below zero from 1854 to 1859 inclusive, and throughout southeastern Pennsylvania it seldom descends below 10°.

So variable is the climate of the northwest, north of the latitude of Chicago, that although a series of winters may occur so mild as not to injure the most tender peach in bud or growth, yet occasionally the cold has been severe enough to kill hardy apple trees. A cold, hard-freezing night in midwinter is sometimes followed by a sunny day, which thaws the frozen bark on the wood, again to be frozen on the following night. This frequently repeated, kills the bark, which shrivels and separates from the wood. A large portion of the apple trees in northern Illinois at the present time are scarred, if not entirely denuded of bark on the southern side; tall trees suffering more in this manner than those having low heads.

Trees grown in timbered lands and on sandy knolls are superior in hardiness to those produced on level prairies. Superabundant moisture, we repeat, being the chief obstruction to successful fruit-growing in the west.

AN ARRANGEMENT OF NATIVE VINES, BASED UPON THEIR ADAPTATION TO THE RESPECTIVE ZONES.

The many varieties of native vines and the hybrids therefrom may be arranged in four classes, having reference to the four zones into which the territory of the United States east of the Mississippi may, from its climatic peculiarities and relative adaptation to the aforesaid arrangement of vines, be properly divided.

The first or very hardy class includes those fitted to endure the extreme cold of the northern zone, and to mature their fruit during the short summer of high latitudes. These all have a close, hard wood, ripened early in the season of growth. They have withstood the winter rigors of the northern States, having been exposed in 1860–'61 to thirty-six degrees below zero without injury.

The most valuable of this class are Clinton, King, Logan, Perkins, and Delaware. From their hardiest representative they may be called the Clinton section. In the lower latitudes of their zone, where a longer season permits the maturity of wood and buds, the Northern Muscadine, Hartford Prolific, and Concord may be included in the above division. These will endure, with the exceptions noted, the extreme rigors of the winters of New England and northern New York as high as the isotherm of 65° without protection.

A second class of hardy vines comprises those that are adapted to a lower zone, where the mean temperature for the four months during which they are maturing their fruit, does not fall below sixty-seven degrees of Fahrenheit. The most valuable of this class are Concord, Adirondac, York Madeira, Marion, Oporto, Hartford Prolific, and N. Muscadine, where their wood is matured, and Union Village in some places; Isabella, in favored localities, as near Cayuga lake, and Diana and Rebecca in similar situations on dry, warm soils, as at Hudson, New York. The above will not always endure the winters of New England nor middle New York, nor of the valleys of the Hudson and Lake Champlain without protection; at least in severely cold seasons. Most of them were killed in the winter of 1860–'61, in Orange county, New York, where the mercury fell to 30° below zero. As the average minimum temperature of New England in this zone is — 15°, that of western New York — 33°, and that of the valley of the Mohawk — 19°, (a temperature of — 40° has been noted at Saratoga,) these varieties will then require protection, and it would be better always to lay them down even if they are not covered with earth

and boughs. Where the grape isotherm of 67° ranges through territory having lower latitude, as Pennsylvania and Ohio, the winter extremes do not prevail, and protection may not always be required. This, from its leading variety, might be called the Concord section.

A third class, or half-hardy vines, includes those which will ripen at places having a mean temperature of seventy degrees for the four months before named, and require a longer season than is afforded in any part of New York, except, perhaps, near the southern shore of Lake Ontario, the region of the minor lakes, and the lower valley of the Hudson river. They find their most favorable localities where the winter mean does not descend below 32° above zero, and most of them will require protection where a degree of cold — 10° is experienced. The most important of this division are the Isabella, Diana, Hyde's Eliza, Maxatawny, Taylor's Bullet. Creveling, and Cuyahoga, Union Village, Rebecca, Lenoir, Elsingburg, Allen's Hybrid, Roger's Hybrids, hardier kinds, and Catawba, in some highly-favored localities. From the leading variety they may be called the Isabella section.

In the fourth class may be placed those vines that will not ripen their fruit north of the grape isotherm of seventy-two degrees. This includes Catawba, Anna, Norton's Virginia, Bland, Brinklé, Clara, Emily, and Raabe, in its northern range, and Scuppernong, Herbemont, Pauline, and Warren, and others further south, and throughout its southern range in the western States. This may be termed the Catawba section.

Though the hardy and very hardy varieties named are those best adapted to withstand the cold and ripen their wood and fruit in shorter northern summers, many of them find in lower latitudes and warmer zones a more congenial climate, and attain therein a degree of perfection never reached further north. Thus the Concord is so highly esteemed in some parts of the west, in lower latitudes, as almost to surpass the Delaware. Many, however, of the hardy varieties are unworthy of cultivation, where the half-hardy or more delicious kinds can be brought to full perfection.

The following notes will illustrate the correctness of our delineation of the isotherms of 65° and 67° throughout New England. Their accuracy might be proved by many pages of authority drawn from voluminous reports and statements of vine-growers, but our limited space forbids enlargement, and the subject can receive at present but imperfect treatment.

In the valley of the Merrimac the hardier varieties may be cultivated, if properly protected from the effects of early frosts and the severity of winter as far north as Manchester; but the valley of the Connecticut is more favorable to the vine than the eastern part of the State of New Hampshire. Here the grape isotherm of 67° is found further north, even as high as Windsor. In elevated localities success cannot always be expected; nor is it always attained even at lower points. At Windsor, Vermont, the Delaware ripened, though its wood as well as that of the Concord, was killed back considerably by an unusually severe winter. Hartford Prolific and Concord also ripened, and even the Rebecca matured some fruit in one locality.

The most favored district for vine culture in northern New England is the valley of Lake Champlain. Here less uncertainty attends the ripening of the hardiest varieties. As far north as Burlington, in gardens, Delaware, Concord, White Muscadine, and Hartford Prolific do well. Its winter extremes are, however, low, the Mercury at Plattsburg having fallen to 14° below zero, and at Burlington, for several years in succession, to 18° and 20°, while at Rupert, at the southern extremity of the valley, enjoying a summer mean of 4° higher, it has fallen to 28° below zero. Here the Clinton and Hartford Prolific and White Muscadine will ripen. The Delaware and Concord do not always mature, and are covered in winter. The Clinton needs no protection, and were

the season long enough for the ripening of their wood those above-named would not need it even in this latitude.

Connecticut, though lying in lower latitudes, does not, owing to the elevation of a large part of the State, present very favorable localities for the growth of this fruit. Pomfret, Middletown, Wallingford, and Cornwall are on the grape isotherm of 64° and 65°, and therefore not more favorable to early maturity than Saco, Maine, or Brandon, Vermont. The Isabella will seldom ripen at Hartford.

The fruit committee of the Massachusetts Horticultural Society reported, in 1859, that the Isabella and Catawba are ripened in New England only in the very best seasons in a few favored localities. The Delaware, Diana, and Rebecca are subject to mildew. Whenever their foliage has been destroyed from that or any other cause, their fruit cannot mature, nor can their wood endure the cold of the succeeding winter, nor can they fruit in perfection the following season. The Isabella seldom ripens in New England; the Catawba never; and even though covered, is not always matured in the open air, not finding the season sufficiently long in Massachusetts. The Hartford Prolific answers the requirements of earliness, which is its chief recommendation, having no other good quality.

MEAN DISTRIBUTION OF SUMMER RAIN IN THE NORTHERN STATES

In the absence of sufficiently extensive and well-defined observations respecting the humidity of our climate, which, if even in our possession would, from the fact that the dry extremes balance those of excessive moisture, scarcely suffice to indicate localities in every respect adapted to the cultivation of the vine, if such exist, we must rely upon the averages of rain-fall in elucidating this part of our subject.

To the "Climatology of the United States, &c.," by Lorin Blodget, a highly valuable work, exhibiting remarkable research and ability on the part of its author, we are indebted for the facts from which we have prepared the following cursory description of the rain districts as they extend over the States of which we treat.

The influence of the relative amount of rain in different parts of the grape zones is of much importance. Though this is not an element that can be relied upon with confidence, as can the periodical return of heat, it may yet, in the average of many seasons, be determined with an approach to accuracy. Throughout the northern States the fall of rain during the summer varies from nine to fourteen inches. The region including all the great lakes from the mountains of northern New York and valley of Lake Champlain to the western extremity of Lake Superior, extending along the southern border of Lake Ontario and the east end of Lake Erie, then passing southeast to include almost all of Pennsylvania west of the Susquehanna, the high region of Virginia to the border of North Carolina, eastern Kentucky, northeastern Ohio, all of Michigan, a small portion of Indiana, and the borders of Lakes Michigan and Superior, in Wisconsin, appear to be favored with a smaller fall of rain during the summer than any other parts of the vine-growing districts of the United States east of the Mississippi. Over this region, which may also properly include the coast of New England, there occurs in summer the average of about ten inches of rain. There is a district over which nine inches only are deposited, but it is quite limited, and extends from Rochester west to the end of Lake Ontario, and not much further south than Buffalo. A similar contracted district of eight inches summer rain-fall occurs in the mountains of Virginia. As regards the fitness of the latter for vine-growing we have no information.

The region over which the fall of nine to ten inches of summer rain extends

includes all the localities where the cultivation of the vine has, in the northern section of our country, been attended with the largest share of success. At Cincinnati and St. Louis the fall of rain for the summer months is about fourteen inches, and this deposit of moisture occurs over most of southeastern Virginia, the Carolinas, where it reaches fifteen inches; most of Kentucky, Middle Tennessee; but equalling that of the Carolinas in the western part of the two last-named States, the southwestern corner of Ohio, the southern border of Indiana, all the south, southwestern and western parts of Illinois, including one-half of the State; southeastern Iowa, and all the eastern half of Missouri to the Ozark mountains.

Between the northern border of the rain district of fourteen inches thus appropriately designated, and which can only be properly defined upon a map, and the district of ten inches fall before noted, there is interpolated a very irregularly shaped region, over which there is deposited in the average of summers about twelve inches of rain. This extends over almost all of New Hampshire, all of Vermont except the northwest corner and valley of Lake Champlain, all of New York except the northeast mountain region, the valley of the St. Lawrence and lake borders before noted, as having nine and ten inches fall, and the lower valley of the Hudson, where eleven inches are deposited. It also includes all of eastern Pennsylvania and southern New Jersey, the northern part resembling the valley of the Hudson, and passing southwestwardly between the two districts before named, extends in a narrow belt through Maryland and Virginia, crosses the mountains in western North Carolina, ranges along the west boundary of Virginia, extends over southern, middle, and western Ohio, nearly all northern and middle Indiana, all northeastern Illinois and Wisconsin, except the lake borders, and over most of Iowa and Missouri not before excepted. This is not generally a favored region for the vine, having an average fall of two inches more than the district of less rains, though more promising than when fourteen inches prevail. The excessive rains which occur throughout the latter region of fourteen inches are frequently destructive to the more tender grapes, and the hopes of the vigneron are often rudely crushed by the loss of three-fourths of the crop from this cause alone.

And such must ever be the experience of those who in this district continue to cultivate the Catawba, Isabella, and other varieties subject to injury from excess of moisture. It is only in the region of lesser rain-falls and within the zones adapted to their needs as respects summer heat and length of season, that we can reasonably hope to find a greater or general exemption from influences so unfavorable.

No section of the northern and middle States is entirely exempted from sudden and enormous falls of rain, amounting in some cases to waterspouts, often quite local; but the section designated as that over which a fall of ten inches of summer rain occurs can be shown by the experience of successful vine-growers to claim greater freedom from injury arising from this cause.

INFLUENCE OF THE LAKES.

The ameliorating influence of our lakes is too marked to escape attention. The peninsula of Michigan, northern Ohio, western New York, and western Vermont show higher temperatures near the lakes, and the abrupt curve of the isotherms from the Upper Mississippi valley to Lake Michigan, proves that altitude is not the cause of their amelioration. The success attending fruit-growing in northwestern New York may be properly attributed to the influences of Lake Ontario and the minor lakes of that district. The spring frosts do not occur so late as at points further in the interior, and the expanse of melting ice retards vegetation until the season is so far advanced that it escapes injury therefrom.

The influence of the waters of Lake Ontario is also apparent in the prolongation of the growing season of the vine on its southern border.

Throughout the month of May the temperature of water taken about one foot beneath the surface is but seven degrees above the freezing point. This is owing to the continued flow of waters from the melting ice of the upper lakes. It gradually rises to that of the atmosphere in the latter part of July, and above it in August. In September it is nearly three degrees warmer, and to the middle of October it retains the temperature of 53°, which is six degrees above that of the air above its southern shore. Its effect in warding off late frosts is thus readily comprehended.

The eastern shores of the lakes are much more safe than those of the west side. Altitudes make a great difference, and the best influence is not felt immediately upon the shore, but some miles distant, often upon higher ground.

Western New York is dotted over with lakes, which lend their softening influences to the climate of this region. In some of these more favored spots, peaches and many of the finer fruits grow in perfection; but on removing to a distance therefrom, and on higher levels, the crop is found uncertain.

In the State of Ohio, at points ten miles inland from Lake Erie, the Catawba is unworthy of cultivation and rarely ripens. On sandy soils along the lake it generally matures, while on the islands, on clayey limestone, it always ripens, and of a quality not uniformly met with elsewhere.

At Kelley's island, (Cunningham's island of the maps,) near the western extremity of the lake, the Catawba is exempt from mildew and the effects of frosts, and almost from the "rot," though 3° further north than Cincinnati, where it is often injured.*

For eighteen years past there has not been a failure of the grape crop at this place, though it has experienced every variety of season incident to the latitude, and the coldest winter and the dryest summer "known to the oldest inhabitant," have occurred within this period. Within the last four or five years vineyards have been planted along the entire lake coast from east of Cleveland to west of Sandusky, a distance of more than sixty miles, and this branch of business promises to become a leading occupation of farmers in this section of Ohio. On Kelley's island alone there have been planted nearly five hundred acres of vines, more than one hundred and fifty of which have borne fruit with an average yield per acre of not less than three tons. Two hundred and fifty tons have been sold as fruit in one season at the average price of about one hundred and twenty dollars per ton, and the remainder devoted to wine.

The thorough drainage and judicious pruning and laying out of these vineyards possess great merit, but to the well-selected locality, surrounded by influences more favorable than elsewhere combined in our country, we must attribute almost entirely their marked success.

This region, says Blodget, corresponds more nearly than any other section to the wine-growing regions of the Rhine.

OTHER INFLUENCES AFFECTING THE GRAPE.

The influence of soils is also very marked in its effect upon the quality, productiveness, and health of the grape.

On the continent of Europe, vineyards that produce the best wine are invariably found on dry soils more or less abounding in lime, and the most celebrated are on the dry, sunny sides of granite or calcareous hills, with the surface terraced, each terrace sustained by a stone wall, against which the vines at its base are trained.

At Hennepin, Illinois, the Isabella has succeeded so well as a table fruit,

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* G. C. Huntingdon in Patent Office Report for 1861.

that the growers have not been induced to seek for anything to compete with it. The Catawba does as well at Hennepin as at Cincinnati, and will produce as good wine, but is not esteemed as valuable as the Isabella for the table or the wine-press, while the latter is much more productive. Soils in which Catawba comes to perfection are sometimes found entirely unfitted for the growth of the Isabella. At the above-named locality the Catawba never rots, while at Cincinnati both this and the Isabella are so susceptible to the "rot" as to suggest the abandonment of their culture.

A damp, foggy morning, followed by a close, warm day, occurring in the Ohio valley any time in the months of June or July, will affect the vines unfavorably, and at the most critical period three such days occurring together will destroy the whole crop.

The soil of Wisconsin is favorable to a luxuriant growth of the wood of most kind of fruit trees, but the severity and the vicissitudes of the climate too frequently counteract the advantage.

The situation of this State is by no means so favorable as that of Michigan and Indiana, over which the mitigating influences of their bordering lake are distributed.

The prevalent western winds sweep their sub-Arctic blasts from the Rocky Mountains and the plains of Nebraska over the entire State.

Grapes can be raised in Wisconsin in light, dry, warm soils, if the vines are protected in winter.

The effects of drainage are here so marked that a Wisconsin fruit-grower has estimated it equal to twenty degrees, or, in other words, that trees on well-drained land will safely endure twenty degrees more cold than if on a wet soil.

Soils too rich in vegetable matter cause excessive growth of roots, and a large vascular system too readily gorged with juices. The inability of the plant to elaborate this excess of nutriment, during damp and hot weather succeeding heavy rains, may be one important cause of the "rot." The manifest injury sustained by vines in heavy, fat loams by the accumulation of moisture, should teach cultivators the imperative necessity of planting in a sandy soil, well drained. Here the effects of drought can be obviated by mulching, and the late succulent growth of shoots, in good measure, be restrained, and both rot and mildew in some degree avoided, if not entirely prevented.

Most of the large vineyards of Missouri are on soil unfriendly to the vine, having compact surface and retentive subsoil. The vineyard in Missouri, where the Catawba does not rot, is on a comparatively poor clayey loam, abounding in pellets of iron resembling buckshot. The soil is deep, underlaid by a stratum of gravel of a foot and upward in thickness, resting on magnesian limestone. The grapes grown thereon are never affected by the "rot," and it produces uniformly good crops. It is in the west-southwestern part of the State of Missouri, a district described by Professor Swallow, the State geologist, as presenting rare inducements to the vine-dresser, appearing to possess the characteristics of soil and climate requisite to success. The extremes of heat and cold are not there so great as in the other vine-growing regions, and in the southern part of the State the atmosphere is sufficiently dry, and though there are occasional changes of temperature so great and sudden as to prove injurious to the grape at certain stages of its growth, yet they are not so marked in the high table-lands of the south and west as in the north and in the valleys of the Mississippi and Missouri. The soils on the bluffs or highlands of this district are not so abundant in argillaceous matter as those on the north and west of the State, and those resting on the magnesian limestone of southern Missouri are by far the best to promote the full perfection of the vine.

THE GRAPE,

AND ITS IMPROVEMENT BY HYBRIDIZING, CROSS-BREEDING, AND SEEDLINGS.

BY GEORGE W. CAMPBELL, DELAWARE, OHIO.

THE success of grape-culture in a large proportion of the United States is no longer problematical; and the large amount of capital invested, and of intelligent industry engaged in this branch of horticulture, renders it not only a subject of local interest, but of national importance. In many sections of the country, vineyards of greater or less extent have been planted, and, where conducted with a reasonable degree of care and intelligence, have been gratifying and remunerative to their owners. Exceptions are believed not to have occurred more frequently than in any other branch of horticulture or agriculture.

For many years the introduction of the foreign European varieties excited the hope of enthusiastic cultivators, who believed that in favored localities these grapes might be acclimatized and made to succeed in open vineyard culture. Experience has, in all cases, proven the delusive character of these hopes; for, after a few years of partial or doubtful success, all such projects have been successively abandoned, and it is finally regarded by intelligent horticulturists as definitely settled that the different varieties of the foreign vine, or *vitis vinifera,* are not adapted to open air culture in this country. The physical character and constitution of the foreign varieties have been found wholly unsuited to the climate of the United States; and seedlings from them have partaken so largely of the same characteristics, that very little, if any, progress has been made towards improvement by their reproduction in this manner.

The leaves of foreign vines are too delicate and thin to resist, uninjured, the extremes of temperature to which they are subjected in this variable climate. They are scorched by our hot summer sun, and enfeebled by drying winds; and, when visited by heavy, driving rains, followed by sultry summer heat, mildew attacks the vine, and blasts at once the fruit and the hopes of the cultivator. That these unfavorable influences are purely climatic, is demonstrated fully by the fact that, when an artificial atmosphere is given by growing them in glass structures, these grapes are produced in perfection, scarcely excelled in their native localities. The foreign vine having entirely failed to meet the requirements of vineyard culture, we must look to our native varieties as the only ones promising continued and permanent success; and only by improvement of these native varieties can we reasonably expect to realize valuable progressive results. A brief notice of the character of some of the native varieties and hybrid grapes cultivated by the writer, and of some experiments looking towards their further improvement by hybridizing, cross-breeding, and selected seedlings, will form the subject of the present paper.

It may be here mentioned that the locality where these observations and experiments were made, though situated near the 40th parallel of latitude, is not particularly adapted to grape-growing, being, on account of its somewhat elevated position, subject to the alternate influences of northern and southern winds, producing great variability of temperature. Frosts, late in the spring and early in the fall, leave a growing season so short that the Catawba grape

rarely becomes well colored, and never fully ripens, except on south walls, or particularly sheltered positions. Peaches are rarely produced, the fruit-buds being almost invariably destroyed during winter, or by late spring frosts. The soil, however, seems well adapted to the growth of the vine; and early ripening varieties are produced as easily and of as fine quality as elsewhere.

In 1852 the Catawba and Isabella were the only grapes upon the list of the American Pomological Society recommended for general cultivation. After the lapse of ten years but three have been added—the Delaware, Concord, and Diana*—and of these five varieties but two, or at most three, can fairly be considered as adapted to general cultivation—the Delaware and Concord, with some doubt as to the Isabella.

While the Catawba grape is very valuable for particular localities, it is too late in ripening to succeed well much north of the Ohio river, except in peculiarly favored situations. Its habitual tendency to rot in many places, and in all in unfavorable seasons, detracts much from its value, even where the season is long enough to mature its fruit. And yet, with all these disadvantages, the Catawba has been more extensively planted than any other grape in the country, and has been found in the aggregate to yield large profits to its cultivators, whether sold in the cluster, or manufactured into wine. In the northern States, except on the islands of Lake Erie, the Catawba is never quite free from pulpiness, and contains considerable astringency at the centre, even while next the skin the juice seems matured, and is pleasant and refreshing. In favorable seasons at Cincinnati, and further south, the pulp becomes soft by hanging late on the vines, and the unpleasant astringency nearly or quite disappears. In this stage of ripeness the Catawba is capable of producing pure wine of superior character.

From these observations it is at once apparent that a grape possessing all the good qualities of the Catawba, with a period of ripening two to three weeks earlier, and without its tendency to rot, would be an acquisition of the greatest importance. Such an acquisition was claimed to have been found upon the introduction of the Diana grape, which is supposed to be a seedling from the Catawba; but, so far as my observation extends, the expectations formed in reference to this variety have not been realized.

Although it colors somewhat earlier, and is eatable even when imperfectly colored, from having less toughness and astringency of pulp; it ripens unevenly, and requires a season nearly as long as the Catawba to become perfectly matured. In size of bunch and berry it is also smaller, and its ability to sustain severe cold without protection is less than that of the Catawba. It has also the same tendency to rot in unfavorable seasons. With all these disadvantages when the necessary conditions exist to ripen it perfectly, the Diana is a very superior grape; and I have eaten its fruit grown upon walls with a southern exposure of a quality unsurpassed by any native variety except the Delaware.

The Concord grape is a more recent introduction, has many qualifications to recommend it for general cultivation, and is one of the most generally popular of all native grapes. Though it cannot be called a fruit of first-rate excellence, it is of good quality, and to most persons very pleasant and acceptable. As usual with new seedling varieties, it has materially improved in quality since its first introduction, and is much better further south than in Massachusetts, where it originated. It is vigorous in growth of vine, very hardy, productive, and ripens its fruit evenly and perfectly from the middle to the last of September. Its strong and luxuriant foliage resists mildew or *oidium*; and I have never known it to rot in unfavorable seasons, and in localities where Catawbas

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* Since the above manuscript was written, the Diana has been stricken off by the American pomological committee, at Boston.

and Dianas have been destroyed. When well grown, its bunches and berries are of large size, often shouldered, quite black, and covered with bloom; skin thin; pulp soft; moderately juicy and sweet, with somewhat of the "foxy" odor and flavor. It does not keep long after taken from the vines. As a wine grape its character is not well ascertained, although Mr. Bull, the accomplished originator of it, and others, have made delicious wine without the addition of sugar.

The Isabella grape is so well known as to require no description. Next to the Catawba, it has probably been more extensively planted in the United States than any other variety. Where well cultivated, and its natural tendency to over bear is checked by proper pruning and judicious thinning of the fruit, it is a profitable and valuable variety, and will ripen its fruit nearly as early, and as far north as the Concord. To have good Isabella grapes the vines should be kept renewed by frequent pruning out of the old wood, and from half to two-thirds of the fruit bunches cut away as soon as possible after flowering. This variety is sometimes disposed to mildew and rot in unfavorable localities, but to less extent than the Catawba.

Of the list recommended by the Pomological Society for general cultivation, only the Delaware grape remains to be considered. It is believed that this variety is by far the most valuable addition made to the list of hardy American grapes, and its introduction is unquestionably destined to produce the most important results to the grape-growing interests of this country. In its healthy habit of growth, hardiness, early ripening, and the unsurpassed quality of its fruit, it more nearly answers the requisitions for a grape adapted to *general* and *universal* cultivation than any other variety yet known. Since its first general introduction, or within the past five or six years, it has steadily and rapidly advanced in public estimation until, by almost universal consent, it is placed at the head of the list. It has been objected that it is of small size and of slow growth.

The former objection must be partially admitted, though good culture has advanced it much in that respect; and, when well cultivated and cared for, the bunches and berries are of full medium size, and a great improvement over specimens exhibited upon its first introduction. As to slowness of growth, this impression doubtless arises mainly from the use of plants enfeebled by excessive production; for, such has been the demand for this variety, that plants have been produced in every possible manner, often from weak and immature wood, and from green cuttings; and vines have been gladly taken by purchasers which were wholly unfit for planting, because no better were to be had. Nothing but weak growth and frequent disappointments could be reasonably expected; but when entire loss has not occurred, such is the native vigor of the Delaware, that it has steadily made its way even against these disadvantages; and, after a year or two, small and weak plants have become established, and made strong and vigorous growth, bearing abundant crops to reward their patient cultivators. Already vineyards of considerable extent are being planted with Delawares about Cincinnati and elsewhere; and the most intelligent vine-growers, after careful and patient investigation, have given this variety their highest approval.

The following is extracted from a published report of a committee upon grapes, appointed by the Cincinnati Horticultural Society, which, I may add, mainly sustains my own experience of about twelve years with the Delaware:

"We have been watching the Delaware grape for three or four years very closely, and found that the vines stand the winter freezing and spring frosts better than the Catawba, equally exposed and unprotected. No rot or mildew has yet been discovered, and no falling of the leaves until the fruit is fully ripe, and it ripens fully three weeks earlier than the Catawba.

"We have eight reasons why we place the Delaware at the head of the hardy grapes:
"1st. Superior quality for table use.
"2d. It produces finer and richer wine.
"3d. The vines stand the winter freezing better than the Catawba.
"4th. They stand the spring frosts better.
"5th. They are not damaged by mildew.
"6th. The grapes never rot.
"7th. No falling of the leaves until the grapes are ripe.
"8th. The certainty of their growing.
"The chairman of this committee has already planted twelve hundred Delawares with such success that he is now preparing the ground for twelve hundred more next spring.

"JOHN E. MOTTIER, chairman,
"DR. S. MOSHER,
"R. BUCHANAN,
"*Committee.*"

The Delaware cannot be considered a rampant grower, though it makes a remarkably vigorous, compact, and healthy growth, especially adapted to vineyard culture. I have known it occasionally to suffer from *oidium,* or mildew upon the leaves in low, undrained, and unfavorable localities, and where the vines had been enfeebled by over-cropping and excessive layering at the same time. But when properly treated I have never known it to fail in making a satisfactory and healthy growth, or in producing abundant crops of well-ripened and most delicious grapes. As compared with the Concord, the Delaware is less robust in its habit of growth, though in hardiness against severe cold it is perhaps superior. As to quality of fruit produced from a given extent of vineyard, there would probably not be much difference. But in quality and value of the fruit the Delaware is unapproachably superior to the Concord in every respect. The Concord will, probably, bear better under neglect and careless treatment than the Delaware; and it is becoming and will continue a very popular variety with those who prefer quantity and ease of production to fine quality.

The Delaware grape would be more popular were its habits of growth more robust, and its fruit larger and more showy; and that there would be particular advantages in larger bunches and berries cannot be denied, if they could be had without any sacrifice of flavor or quality. Very many persons prefer the sprightly and refreshing vinous flavor of the Delaware to that of the finest exotic varieties carefully raised under glass; and it is unquestionably true that a grape possessing all the fine qualities of the Delaware, and its adaptability to open air culture, accompanied by the size of the Black Hamburgh, would be an acquisition of almost incalculable value. I may here remark, that the hope—rather than the expectation—of producing something of this character has impelled me to make, through a series of years, a succession of experiments in hybridizing, cross-breeding, and in raising natural seedlings, which, whether successful or not, I shall probably continue during my natural existence. Up to the present time, it must be confessed, the results of my experiments have been curious and interesting, rather than valuable. But, contrary to the opinions of many writers, I have succeeded, in common with others, in demonstrating that the structural and physical difficulties in the way of hybridizing the grape successfully are not impossibilities, and that they may all be overcome, and cross-breeds and hybrids produced at will, and with unerring certainty, either between different varieties of natives, or between native and foreign varieties.

Before remarking further upon the subject of hybridizing, I will notice the grapes upon the list of the American Pomological Society, recommended as "promising well." These are four in number—the Herbemont, Logan, Rebecca, and Union Village. The Herbemont has been found valuable at the south, both as a grape for the table and for wine, and it is certainly a fruit of very high character when well matured.

I have, however, never seen a good specimen ripened north of Cincinnati, and the objections urged against the Catawba for general cultivation, on account of lateness of ripening, would equally apply to the Herbemont. It is also somewhat tender in winter, and will not succeed well in this latitude, except on walls, or warm sunny exposures, which are shielded from early and late frosts.

The Logan is a strong, healthy vine, perfectly hardy, sustaining uninjured the severest winters unprotected, and ripening its fruit very early. It is a black grape; berry about the size of the Isabella, which it somewhat resembles; but in the form of its bunches it is usually straggling and imperfect, as it does not set its fruit well. In quality it is good, being more sprightly and vinous than the Isabella, and would be a desirable variety if its bunches were larger and more uniform. I have used the Logan as a pistillate, in several of my hybridizing experiments, on account of its earliness, hardiness, and healthy, vigorous growth, (all especially desirable qualifications,) relying on the staminate parents for improvement in quality.

The Rebecca is a white or light-green grape, with a salmon tint, where exposed to the sun, of superior quality, but of delicate and slender habit of growth, much disposed to attacks of mildew while young, and usually rather a shy bearer. Its bunches, especially on young vines, are small, rather compact, with good-sized berries; requiring protection in severe winters, and particularly desirable only for gardens, and for amateur cultivators who will give it good care and culture. Its tendency to mildew, however, greatly decreases as the vines acquire age and strength.

The Union Village is one of the largest and most showy of our native grapes, being very much like the celebrated Black Hamburgh in size, color, and appearance. In quality, it resembles the Isabella, of which it is said to be a seedling, and is by many persons preferred to that variety. It is a most luxuriant grower, and young vines especially, need some protection from severe cold in winter. This completes the list of grapes recommended by the Pomological Society, both for general cultivation and as "promising well." A very large number of other varieties have also been introduced within the past few years from various sources, and, while many of them will never deservedly acquire more than a limited and a local reputation, a smaller number may prove valuable acquisitions. A few of these will be noticed, partly because they have been used in hybridizing experiments, and partly because of the belief that they may of themselves be worthy of further trial and cultivation.

The Creveling, known also in some localities as the Catawissa, or Bloom grape, was first exhibited before the Pomological Society at Philadelphia in 1860, fully ripe, on the 11th of September, color black or blue-black, bunches long, rather large, not very compact, but of good form. In quality juicy, with very little pulp, sprightly, moderately rich, and very good. It seemed more perfectly ripened than any native variety on exhibition except the Delaware. Two years' experience induces the belief that it is a grape valuable for its hardiness, earliness, productiveness, and good quality. It is also of strong, vigorous, and healthy growth, fully as early as the Hartford Prolific, while in quality it is greatly superior to that variety. The Cuyahoga, which originated near Cleveland in this State, is one of the class of light-green or amber-colored grapes, usually called white. For southern localities, sheltered situations, and south or east walls, it is a desirable variety. Is of much stronger growth than the Rebecca, though, like it, rather disposed to mildew while growing. It did not suffer from rot the past season, though Catawbas, Dianas, and other varieties were badly injured in the same locality. It is a grape of fine, high flavor, thin skin, very little pulp, and, except that is too late in ripening, a desirable acquisition. Its period of ripening is about the same as that of the Catawba.

The Lydia is another new seedling, which originated on Kelley's island, in Lake Erie. It resembles the Cuyahoga in foliage and general growth of the vine, as also in the color and appearance of its fruit. Its berries are, however, larger, with rather thicker skin, and somewhat more consistency of pulp. In flavor it is less vinous, but more saccharine than the Cuyahoga, and ripens three weeks earlier. Regarded as a promising variety.

The Anna is a white grape which has been for some time before the public, but of the value of which reports are very contradictory. It has been here of rather slow and dwarfish habit of growth while young, but improves in that respect after three or four years. When fully ripe it resembles the Diana in quality, but is more pulpy, a little "foxy," and more astringent at the centre. Bunches and berries of medium size, and period of ripening about the same as the Catawba. It is probably a seedling of that variety, and, like it and the Diana, is disposed to rot in unfavorable seasons.

The Alvey is a grape not generally known or disseminated, of the Herbemont, Lenoir, and Lincoln type. It seems, however, of better habit of growth, and the earliest in ripening of its class. A somewhat limited experience hardly warrants any positive statement; but it appears, as far as tested, equal in quality and productiveness to either of the above-named kinds, while its earlier ripening renders it more desirable, especially for northern localities.

Taylor, or Taylor's Bullet, is a small, white grape, with large seeds, which was introduced some three or four years since, with the announcement that it was "better than the Delaware," and a great acquisition to the list of native varieties. It is a vine of remarkable vigor of growth, raised as easily from cuttings as currant-bushes or willows, and ripens its fruit early, but here its value ends. It sets badly, having usually not more than six to twelve berries on its straggling and irregular bunches. In flavor it may be called negative, having no decidedly bad taste, nor any particularly good. Is undoubtedly inferior and unworthy of cultivation.

Another class of grapes, claimed to be hybrids between native and foreign varieties, will now be noticed, as preparatory to some account of my own experience in that line, and to a general consideration of the probabilities of the permanent and valuable improvement of grapes through the agency of artificial hybridizat on.

Mr. John Fisk Allen and Mr. Edward S. Rogers, both of Salem, Massachusetts, are, so far as I know, the only persons who have introduced grapes to public notice which are undoubtedly produced from artificially impregnated seed, and which are true crosses between native and foreign varieties.

The first named of these gentlemen originated the variety known as Allen's White hybrid, which was produced by impregnating the Isabella with pollen from the Golden Chasselas. This is a grape of remarkably interesting peculiarities. Retaining much of the habit of the Isabella, it has also very marked characteristics of its foreign parent. Judging from four years' experience, I regard it as a decided advance in the way of improvement. Though perhaps not quite as hardy as the Isabella, it is apparently as vigorous in growth, ripened as early, and has shown no greater disposition to mildew than that variety. In color, general appearance, and flavor of its fruit, it is very much like the Golden Chasselas.

Grapes borne for two years upon young vines in open air have differed, in no important particular, from Chasselas grown under glass, except that the bunches and berries are somewhat smaller. Young vines of this variety have not been very productive, but may be expected to improve in that respect when older. The foliage partakes somewhat of the character of both parents. In general contour the leaf is not unlike that of the Isabella, usually sub-cordate, entire or very obscurely lobed, with rather coarsely dentate edges. It is, however, nearly smooth, or glabrous, on the under side, like the foreign leaf, instead

of tomentose, like the Isabella. So much do the young plants resemble Isabellas in appearance, that in some instances, when this hybrid and Isabella were planted near each other, I often found it difficult to distinguish them while growing without examining the under side of the leaves. Mr. Allen has also produced other hybrids, none of which, however, have yet been introduced to general notice.

Mr. Rogers's experiments are also interesting and valuable; and although in quality the grapes he has produced are not superior to many others in cultivation, the beneficial and ameliorating influences of hybridizing are most clearly demonstrated. Selecting, as the pistillate parent, the wild "Mammoth" grape of New England, a fox of the strongest odor, and of most execrable and uneatable quality, he fertilizes it with pollen from the Black Hamburgh and the Golden Chasselas. The desirable qualities possessed by the Mammoth were great vigor of growth, earliness, hardiness, and large size, though with usually but four to six berries in a bunch. From these crosses, Mr. Rogers produced more than forty different hybrid seedlings. Ten of the most promising of these, which were sent to me by Mr. R. some years ago, have borne fruit the past two years. While they all differ materially from each other, they bear strong evidence of their mixed origin, and are truly wonderful improvements upon their foxy mother. The ameliorating influences of the foreign varieties are also clearly and unmistakably apparent. All those crossed with the Black Hamburghs which I have seen, bear berries equal in size to that variety, and many of them had also handsome, compact, and often shouldered bunches nearly as large. These hybrids have not been named, and are as yet distinguished only by numbers, and in the following brief descriptions of those which I have personally tested the numbers used by Mr. Rogers are given:

No. 1. A light-colored grape of the Hamburgh cross, and of the largest size; often flushed with pale red; sometimes striped when fully exposed to the sun; usually light yellowish-green or amber-colored in the shade; thin skin, tender pulp; in consistence much like the Hamburgh; sweet and pleasant, very good, but not particularly high-flavored. Ripens with the Isabella.

No. 2. Very large black grape, handsome bunches, with more acid, but more vinous in flavor than No. 1. Ripens about the same time.

No. 3. Large, oval, light-reddish, purple grape, color much like the Catawba; in quality very good, and somewhat like the Diana. Earlier than Isabella.

No. 4. Very large and very productive; bunches and berries nearly as large as well-grown Black Hamburghs, which variety it closely resembles in color and general appearance; in quality, equal to Isabella, Concord, or Union Village. Ripens fully as early as the Isabella.

Nos. 5, 9, and 13, are crossed with the Chasselas. They are all smaller in size than the Hamburgh crosses, and of different flavor and character. No. 13 retains more of the native character and flavor than any of the others, but is sweet and good, having lost entirely the acid astringency which characterizes the Mammoth. No. 9 has less of the native character; otherwise much like No. 13, and very good. All these ripen earlier than the Isabella.

No. 15 is of the Hamburgh cross, very large, of dark-purplish red or maroon color, often mottled, with a peculiarly rich, aromatic flavor, very pleasant to most persons. This variety is regarded by Mr. Rogers as the best grape in the collection.

No. 19. Not quite as large in bunch and berry as No. 4, but rather better in quality. Early and promising.

No. 33. Another variety of the Hamburgh cross; very large; color black; flesh tender; flavor sweet, rich, and good; juice deep red, next the skin. Early, and one of the most promising.

The quality of these hybrids, taken together, is really most remarkable, when it is considered that they were all grown from a seed of the fox grape of the

vilest character both in taste and smell, the ameliorating influence of the foreign parent entirely eradicating all traces of fox odor in most of the varieties; and the flavor so chastened that the wild element is less prominent than in many of the popular cultivated varieties.

The following extract from a letter written by the Hon. Marshall P. Wilder, President of the American Pomological Society, to Mr. Rogers, upon the reception of some of these hybrids, will show his appreciation of them:

> "I have never doubted that the proper hybridization of our native with the foreign grapes would be productive of great improvement; but, considering the care requisite in the judicious crossing of the varieties, I have been apprehensive that not much would be realized at present from that source. I am, however, no longer incredulous. You have accomplished the work; you have achieved a conquest over nature, and your efforts will constitute a new era in American grape culture. The size, flavor, and beauty of several of the sorts will render them decided acquisitions to our list of hardy grapes. I was especially pleased with the delicate aroma of those no longer retaining the strong foxy taste of the mother, but the rich, chastened flavor of the Diana. Some of these, I think, will prove superior to that excellent sort."

All these hybrids retain the strong, vigorous growth, and apparently the hardiness of their native parent, exceeding in these respects the Isabella, Catawba, and Concord. But one of these has shown any mildew, (No. 13) and this very slight. They are also as early, or earlier in ripening than the Isabella.

While the success of Mr. Rogers is very gratifying, and the results very interesting, the inference is palpable that his success would have been greater and more valuable had he chosen for the pistillate or female parent a grape of better quality. It is true that he has re-hybridized several of the best of his varieties with other foreign kinds and has produced from them seedlings superior to the original hybrids, but they have, as yet, been fruited only under glass. Whether the double crossing does not infuse too much of the foreign element to leave them still adapted to open culture, and whether they are sufficiently early to ripen well, remains to be seen. The probability is that some of them will be suited to out-door cultivation and be very desirable acquisitions.

In the practical application of hybridizing there are many difficulties to be overcome, particularly where natives are to be impregnated with pollen from foreign varieties; and all seedlings claimed to be hybrids simply because native and foreign varieties from whence seed were taken had grown together, are undoubtedly erroneous. The stigma of the foreign vine is usually self-impregnated before its caducous covering falls from the embryo berry. This, in addition to the fact that there are several days, if not weeks, between the period of inflorescence of the native and foreign vine, renders it nearly impossible that a hybrid should be produced by chance or natural causes. The bursting of the pollen-cells and impregnation in our native varieties does not usually take place until some hours after inflorescence, and there is consequently less difficulty in the way of their artificial impregnation than in the case of the foreign kinds.

The only certain and reliable mode of procedure is to open the buds artificially, before their natural period, and remove all the anthers before there is a possibility of pollen having been formed. Then, if the denuded stigmas are kept entirely isolated from all possible contact with pollen other than that with which they are desired to be crossed, and this be applied at the proper time for impregnation, hybrids or cross-breeds will be the inevitable result from the seed of the bunches thus treated. Where foreign varieties are grown under glass in a cold vinery, I have found them to bloom at the same time as the natives in the open air, and have never had difficulty in obtaining pollen for my experiments from vines thus grown. The greatest care with delicate instruments and exceedingly delicate manipulations is required to conduct these operations successfully, and when it is accompanied with the reflection that about *ten years* of further care and culture will be requisite before determinate results are

reached, and when the chances may be ten, or perhaps a hundred to one that the product will be of no value, a good deal of enthusiasm as well as a sanguine temperament is necessary to enable the hybridizer to find much encouragement in his pursuit. He must be emphatically one who is willing

"To labor and to wait."

In all experiments my aim has been to produce vines possessing the characteristics of vigorous and healthy growth, hardiness, earliness in ripening, and improved quality of fruit. Recognizing fully the fact that a large number of the new varieties introduced are of no particular value, and that there is no useful object in multiplying new sorts which are in no important particular superior to old ones, I have in the selection of varieties for hybridizing and cross-breeding always had some definite object, subservient to the views above expressed. Some valuable quality in both parents, desired to be perpetuated, has determined their use, and I am happy to say that, so far as tested, many of my anticipations have been realized, the results justifying the correctness of the principles upon which the experiments were conducted.

My first experiments, commenced in 1856, were directed towards an improvement upon the Delaware, with a view of increasing the size of the fruit and producing a stronger growth of the vine. To this end I selected seed from the largest and finest Delaware grapes taken from the most vigorous vines, which I planted naturally. I also crossed the Logan grape with the pollen from the Delaware, and at the same time crossed the Delaware with the foreign variety believed to be the Ferrar or Black Portugal, a large black grape of peculiar cherry-like flavor, which bears enormous bunches and is of very vigorous growth. I made, at the same time, a cross upon the Logan with pollen from the White Frontignan. In order to test in every way the accuracy of these experiments, I also prepared another bunch of the Logan, by removing the anthers as if for hybridizing, but applied no pollen, leaving it isolated until the berries upon my other experiments had commenced growing sufficiently to prove that impregnation had been successful. I then removed the covering from the bunch to which no pollen had been applied, and found that every berry but one had blasted and fallen off. This one, evidently later than the rest, appeared, by the little drops of viscous fluid upon its stigma, to be in the proper condition for impregnation, and I immediately applied pollen from Chasselas Musqué, and again covered it for a few days. Upon removing the covering I found that the fertilizing had been successful, and a grape, bearing two seeds, was the result, from one of which a promising hybrid was obtained. This experiment, taken in connexion with the fact that in the other cases where pollen was applied nearly every berry became fertilized and grew to perfection, was very satisfactory. This has subsequently been confirmed to the extent of producing handsome and compact bunches upon varieties that never set their fruit well naturally, and where the only perfect bunches formed were those artificially impregnated.

Seed from these hybridized and cross-bred grapes were carefully saved and labeled, and early in the spring following planted in the smallest sized propagating pots, one seed in each. The greater number of these seeds vegetated, having the usual diversity of foliage characteristic of seedlings. Each class, or different cross, however, had strongly marked, distinguishing features. The cross between Logan and Delaware produced on many seedlings foliage intermediate between the two varieties; others more nearly resembled the Logan; and others again the Delaware. In advanced growth the wood presented the same diversity of appearance, some of the seedlings having the peculiar blackish gray-colored wood of the Logan, and others the rich red-brown of the Delaware. The seedlings, however, from the Logan crossed by the foreign varieties exhibited the most striking peculiarities, having the deeply indented, fine-lobed foliage of the foreign parent, and being so perfectly distinct from seedlings of

the same variety crossed with the Delaware, as to strike at once the most casual observer. The seedlings from the Delaware crossed with the foreign Black Portugal were not less remarkable in their varied appearance from seedlings of the Delaware not hybridized. The latter vary very little from the foliage of the parent, and all have a strong family likeness; while all those produced from hybridizing with foreign varieties, change their foliage in the same striking manner, having the leaves deeply lobed, and decidedly foreign in appearance.

An interesting fact in reference to seedlings is, that their future vigor and general habits are indicated in their earliest stages of growth. Those that are weak and puny at first never seem to lose this peculiarity; and those having blanched or imperfect foliage, observable often, even in the cotyledons, never by any treatment which I have been able to give could be made smooth and healthy. Some, upon being planted in open ground, are attacked with *oidium* or mildew, and become weak and unhealthy, while others remain strong and vigorous, with fresh, thick, and glossy foliage, retaining their leaves and ripening their wood perfectly. Delicate, imperfect, or unhealthy plants are at once discarded as unworthy of attention, and only those retained which seem to possess specially desirable characteristics. These remarks apply not less to natural seedlings than to hybrids or cross-breeds.

Of the many hybrids, seedlings, and cross-breeds which I have produced but few have yet borne fruit, and of these I am not inclined to say very much, as I do not consider them sufficiently developed to warrant confident assertions or decided opinions. Some of them, I am satisfied, will never have any practical value; others I think promising. Of a few of these I will give brief descriptions.

1st. A cross-breed of Delaware upon Logan, from Logan seed; vine, from the first, vigorous, healthy, and perfectly hardy; foliage much like the Logan; wood dark, reddish-brown, intermediate in appearance between Delaware and Logan; bloomed in 1861, but fruit buds destroyed by frosts on the 4th of May; fruited in 1862, ripened early, and before Concord, Delaware, and Logan, all growing in the same locality; color black, berry oval, medium size; bunch medium and compact, in form resembling Delaware; skin thin; flesh tender; juicy, claret-colored next the skin; flavor as nearly as possible a mixture between that of the Logan and Delaware; not as good as the latter, but an improvement upon the former; very productive, each lateral showing three to four clusters. Should this variety improve in quality for a series of years, as is usual with seedlings, it may prove a valuable acquisition.

2d. The same cross as the above; vine vigorous and healthy; foliage intermediate; fruit very small, black, resembling the wild frost grape, but, unlike that variety, ripens early, and has a thin skin and very small seeds, proportioned to the size of the berry; in flavor pleasant, and not unlike the first described. Curious, but of no probable value.

3d. Hybrid cross of Ferrar or Black Portugal, upon Delaware, from Delaware seed; vine of remarkably strong, rapid, and luxuriant growth; wood, in texture like Delaware, but darker in color; foliage large, dark-green, deeply lobed, and of great consistence, the leaves being remarkably thick, almost leathery in texture, remaining healthy, and hanging upon the vine until destroyed by frosts; is very late starting in the spring, and blooms at the same time as Herbemont and Lenoir; fruit black, medium size, skin thin, flesh with the consistence of the foreign parent, and apparently intermediate between it and the Delaware in flavor; fruited the present season for the first time; regarded as promising, though it ripened later than the Delaware, and about the period of the Isabella. Several others of the same cross, which exhibit considerable diversity in wood and foliage; will probably fruit next season—1863.

4th. Hybrid cross of Chasselas Musqué upon Logan, from Logan seed; vine vigorous, perfectly hardy, and healthy; foliage, intermediate. Fruit, first

bearing, black, oval, medium size; flesh, tender; skin, thin; flavor, sugary, vinous, very rich; ripened very early. Should this variety, upon further trial, prove productive with handsome bunches and berries, it will undoubtedly prove valuable.

5th. Seedling Delaware. Vine vigorous, hardy, and healthy. Foliage much like the Delaware, but leaves less frequently lobed. Wood rather darker color, and apparently harder and more compact even than that of its parent; bunches compact; berry larger than the Delaware; color, light yellowish-white; skin, thin, semi-transparent, covered with delicate white bloom; flesh tender, with no pulp, but equal consistence from the skin to the centre; in flavor the counterpart of the Delaware; fruited the first time this season, and regarded as very promising. In addition to the above mentioned I have many other Delaware seedlings, among which is still another white grape, but not as promising as that described. I have also hybrids, growing from crosses of Black Hamburgh upon Logan; Black Hamburgh and White Frontignan upon Delaware. Also native cross-breeds of Catawba upon Logan and Delaware upon Concord. In nearly all these crosses the characteristics of each are so peculiar and distinctive that either could be unerringly separated from the others by the foliage alone.

The cross-breeds between the Logan and the Catawba present some interesting features, principally in their wood and foliage.

Nearly all of them, however, have the light-colored reddish brown wood of the Catawba. Though quite distinct in leaf and wood from any other cross, a part of them have foliage somewhat resembling the Catawba; others mixed, and of the Logan character; others still are more like the native fox-grape, with cordate leaves, densely tomentose on the under side. One of them, however, is entirely distinct from all the rest, having long, slender, wiry, light gray wood, leaves small, sub-cordate or obscurely lobed, glabrous on both sides, apparently identical with the wild type of the *Vitis Æstivalis* found in the forests. Had not every stage of the progress of this vine been conducted by my own hands, I should doubt its identity, it is so entirely distinct from all its companions and from any other seedling I ever raised.

The seeds for all my experiments are taken from the grapes, and carefully labeled by myself. They are planted in compost in small pots, one seed in the center of each, carefully marked, and each kind kept separate. This wild individual I noticed when it first came up as differing from the other seedlings of the same lot. It will probably prove a staminate, or barren variety. It has been asserted that hybridized grapes would produce only infertile seed. The statement is erroneous; for I have produced plants from Allen's white hybrids, and from several of the Rogers hybrids, and find the seed from these varieties to vegetate as easily and as surely as any others.

In conclusion, I will mention that I have the present season rehybridized several of the most promising of Rogers's hybrids with Delaware, Black Hamburgh, White Frontignan, and Chasselas Fontainebleau; the Creveling with the same foreign varieties, the pollen mixed promiscuously; and the Taylor or Bullet with White Frontignan and Chasselas Fontainebleau.

In planting grape-seed promiscuously, without crossing, hybridizing, or special selection, the chances for improvement or valuable results are very remote, for the tendency seems to be almost invariably to return to the original or wild type.

While this is true as a general principle, there seems to be also an inherent tendency toward improvement, which only exhibits itself at rare intervals. To this occasional tendency we are probably indebted for all our most valuable varieties, excepting the hybrids of Messrs. Allen and Rogers, including the Isabella and the Catawba, as well as the Concord, Rebecca, Diana, Herbemont, Union Village, Cuyahoga, Creveling, Lydia, and, doubtless, also the Delaware.

My experiments and observations in hybridizing thus far seem to indicate that the chances for improvement are greatly increased by its influence; but that it does not entirely overcome the tendency of seedlings to sport or return to the wild state. And in growing natural seedlings, that carefully selected seeds from fruit possessing some unusual excellence, are much more likely to produce improved varieties than those taken promiscuously.

ON THE CULTURE OF SWEET POTATOES

AT THE NORTH, AND THE MODE OF PRESERVING THEM THROUGH THE WINTER.

BY J. C. THOMPSON, TOMPKINSVILLE, (STATEN ISLAND,) N. Y.

It is not known how far north sweet potatoes can be raised, but it is probable that on a sandy soil and with a southern exposure they may be successfully grown in portions of Vermont and New Hampshire, or even in Maine. Attempts to raise them have often been defeated by excessive care in preparing the ground, or in not knowing how to preserve them after they are dug. When they are planted in too deep a soil, the tuber runs down too deep and becomes watery and insipid.

PLANTS OR SLIPS.

About the first of April—a little later, perhaps, in locations north of New York—put the potatoes in a hot bed. If they are large, split them lengthwise, laying the flat side down. They may be placed so near as almost to touch each other; then cover about two inches deep with a light rich compost made of fine sand, manure, and good soil or leaf-mould from the woods. When the sprouts push above the ground add an inch more of the compost. Water occasionally with warm water; keep the bed warm at night, and on fine days give them air and sunshine to render them hardy. When ready to set, the sprouts may be pulled off, or the potato may be lifted out and the best plants selected and the potato be returned to the hot-bed. A bushel of seed will produce from three to five thousand plants, and every thousand plants which are set should produce forty bushels of potatoes.

PLANTING THE GROUND.

A warm, sandy loam is best adapted to the culture. Mark spaces three feet apart, merely scratching the ground, for the rows, which should run north and south. On the marks spread barn-yard manure with a fork; then turn up the earth with a plough from each side toward the manure, and form a ridge about ten inches high, and finish the ridge with a rake. The base of the ridge, which should be a foot in width, should not be disturbed by the plough. The top of the ridge when finished should be flat and three or four inches in width.

Plants should be set as soon as all danger from frost is past. I have obtained fair sized potatoes when planted the 1st day of July, but I do not advise late planting.

PLANTING ON SOD.

Sweet potatoes will grow more chubby when planted on sod than when planted in any other way. Strips of sod eight or ten inches wide can be laid in line on the surface of the ground with the grass side up, manure strewed on them, and the earth turned up on each side so as to form a ridge, as directed above; or a piece of pasture or meadow may be selected, and the turf used as the base of the ridge to be formed by the plough. In either case manure or rich compost should be used; for, unlike Irish potatoes, these are not injured, but are greatly benefited by manure.

SETTING THE PLANTS.

A marker should be used to prick off the spaces for the plants, sixteen inches apart. A boy is then able to drop the plants in the right places, and the hole is made for setting them. The plant should then be put in the ground down to the first leaf, and the earth pressed gently around it. Care should be taken to set the plants when the ground is moist, and, if possible, on a cloudy day.

AFTER TREATMENT.

Keep the weeds subdued. Use a hoe or a rake, raking upward toward the plants. Where the plants run down the ridges, lift and lay them on the top. Do this several times during the season, in order to permit the sun to act upon the ground.

GATHERING AND PRESERVING.

For early use feel in the ridges, and nip from the stem those that are fit for use, leaving the others to grow. For winter use, after the first frost select a dry, clear day. Cut the vines with a scythe, leaving the stem to which the potatoes are attached three or four inches long to lift them by. The vines are readily eaten by cattle. Use a fork for raising the potatoes; lift them by the stem, and lay them on the ridge to dry. In a few hours they will be ready to pack. Prepare plenty of dry, cut straw, (old straw is preferable,) and take straw and barrels or boxes to the field. Select the best potatoes, handling them carefully, without bruising them. Put a layer of straw at the bottom of the barrel, and then alternate layers of potatoes and straw until it is filled. The potatoes should be placed close to each other, one at a time, and handled as carefully as eggs. The barrels are then to be moved to a dry room or cellar, where there will be no frost. If they are placed in a cellar they must be raised from the floor, and must not touch the wall. *Keeping warm and dry* is the secret of their preservation. They will keep six or eight months and improve in quality. From one plot of ground 39 by 100 feet I gathered, in October last, 43½ bushels.

REMARKS ON THE PHYSIOLOGY OF BREEDING.

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Upon few subjects connected with rural economy, probably upon no single one, is there greater need of diffusion of knowledge than in regard to the principles of breeding. Many engaged, more or less, in stock husbandry are utterly ignorant of them. With others who have studied somewhat, or perhaps have written upon the subject, the alpha and omega of their philosophy is embraced in the axiom that "like begets like."

Now, this axiom is a very good one, *as far as it goes;* and if our farm animals were now in the condition in which nature produced them, and if this condition best subserved the wants of the agriculturist, it would approximate nearer to a sufficient guide in breeding; but with domestication came in disturbing influences, and the effects of these have been deviations numerous and great; changes external and internal in form and in constitution.

By virtue of some of these changes great improvement has been attained. Our most valuable animals are, in some sense, a manufactured article; and the skill which originated them is needful to continue and increase them, while ignorance of the physiological laws connected with their reproduction and improvement will serve to perpetuate and multiply lamentable deficiencies, defects, and general unprofitableness.

The object of the husbandman, like that of men engaged in other avocations, is *profit;* and, like other men, the farmer may expect success in proportion to the skill, care, judgment, and perseverance with which his operations are conducted.

The better policy of farmers generally is to make stock husbandry, in some one or more of its departments, a prominent aim—that is to say, while they shape their operations according to the circumstances in which they are situated, these should steadily embrace the conversion of a considerable portion of the crops grown into animal products, and this because by so doing they may not only secure a present livelihood, but best maintain and increase the fertility of their lands. In fertile grain-growing districts, like our prairie States, the importance of *maintaining* fertility is often unheeded; but the deterioration, by undue cropping, is not less sure, although tardier in manifesting itself, than where the natural resources of the soil are less abundant.

The object of the stock-grower is to obtain the most valuable returns from his vegetable products. He needs, as Bakewell happily expressed it, "the best machine for converting herbage and other animal food into money." He will therefore do well to seek such animals as are most perfect in their kind—such as will pay best for the expense of procuring the machinery, for the care and attention bestowed, and for the consumption of raw material. The returns come in various forms. They may or may not be connected with the ultimate value of the carcass. In the beef-ox and the mutton-sheep, they are so connected to a large extent; in the dairy-cow and the fine-wooled sheep, this is a secondary consideration; in the horse, valued as he is for beauty, speed, and draught, it is not thought of at all.

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Not only is there a wide range of field for operations, from which the stock-grower may select his own path of procedure, but there is a demand that his attention be directed *with a definite aim*, and *towards an end clearly apprehended*.

The first question to be answered is, What do we want? and the next, How shall we get it? What we want depends wholly upon our situation and surroundings, and each must answer it for himself. In England, the problem to be solved by the breeder of neat cattle and sheep is how "to produce an animal or a living machine, which, with a certain quantity and quality of food and under certain given circumstances, shall yield in the shortest time the largest quantity and best quality of beef, mutton, or milk, with the largest profit to the producer and at least cost to the consumer." But this is not precisely the problem for American farmers to solve, because our circumstances are different. Few, comparatively, at least in the northern States, grow oxen for beef alone, but for labor and for beef, so that earliest possible maturity may be omitted and a year or more of labor intervene before conversion to beef. Many cultivators of sheep, too, are so situated as to prefer fine wool, which is incompatible with the largest quantity and best quality of meat. Others, differently situated in regard to a meat market, would do well to follow the English practice, and aim at the most profitable production of mutton. A great many farmers, not only of those in the vicinity of large towns, but of those at some distance might, beyond doubt, cultivate dairy qualities in cows to great advantage, and this too, even if necessary, at the sacrifice to considerable extent of beef-making qualities. As a general thing, dairy qualities have been altogether too much neglected in years past. Whatever may be the object in view, it should be clearly apprehended, and striven for with persistent and well-directed efforts.

To buy or breed common animals of mixed qualities, and use them for any and for all purposes, is too much like a manufacturer of cloth procuring some carding, spinning, and weaving machinery adapted to no particular purpose, but which can, somehow, be used for any, and attempting to make fabrics of cotton, or wool, and of linen with it. I do not say that cloth would not be produced, but he would assuredly be slow in getting rich by it.

The stock-grower needs not only to have a clear and definite aim in view, but also to understand the means by which it may best be accomplished. Among these means a knowledge of the principles of breeding holds a prominent place, and this is not of very easy acquisition by the mass of farmers. The experience of any one man would go but a little way towards acquiring it, and there has not been much published on the subject in any form within the reach of most. Indeed, from the scantiness of what appears to have been written, coupled with the fact that much knowledge must exist somewhere, one is tempted to believe that not all which might have done so, has yet found its way to printers' ink. That a great deal has been acquired we know, as we know a tree by its fruits. That immense achievements have been accomplished is beyond doubt.

The improvement of the domestic animals of a country so as greatly to enhance their individual and aggregate value and to render the rearing of them more profitable to all concerned, is one of the achievements of advanced civilization and enlightenment, and is as much a triumph of science and skill as the construction of a railroad, a steamship, an electric telegraph, or any work of architecture. If any doubt this, let them ponder the history of those breeds of animals which have made England the stock-nursery of the world, the perfection of which enables her to export thousands of animals at prices almost fabulously beyond their value for any purpose but to propagate their kind; let them note the patient industry, the genius, and application which have been put forth to bring them to the condition they have attained, and their doubts must cease.

Robert Bakewell, of Dishley, was one of the first of these improvers. Let us stop for a moment's glance at him. Born in 1725, on the farm where his father and grandfather had been tenants, he began at the age of thirty to carry out the plans for the improvement of domestic animals upon which he had resolved as the result of long and patient study and reflection. He was a man of genius, energy, and perseverance. With sagacity to conceive and fortitude to perfect his designs, he laid his plans and struggled against many disappointments, amid the ridicule and predictions of failure freely bestowed by his neighbors, often against serious pecuniary embarrassments, and at last was crowned by a wonderful degree of success. When he commenced letting his rams, (a system first introduced by him and adhered to during his life in place of selling,) they brought him 17*s.* 6*d.* each for the season. This was ten years after he commenced his improvements. Soon the price came to a guinea, then to two or three guineas, rapidly increasing with the reputation of his stock, until, in 1774, they brought him a hundred guineas each! Five years later his lettings amounted to $30,000!

With all his skill and success he seemed afraid lest others might profit by the knowledge he had so laboriously acquired. He put no pen to paper, and at his death left not even the slightest memorandum throwing light upon his operations, and it is chiefly through his cotemporaries, who gathered somewhat from verbal communications, that we know anything regarding them. From these we learn that he formed an ideal standard in his own mind and then endeavored, first by a wide selection and a judicious and discriminating coupling, to obtain the type desired, and then by close breeding, connected with rigorous weeding out, to perpetuate and fix it.

After him came a host of others, not all of whom concealed their light beneath a bushel. By long-continued and extensive observation, resulting in the collection of numerous facts, and by the collation of these facts of nature, by scientific research and practical experiments, certain physiological laws have been discovered and principles of breeding have been deduced and established. It is true that some of these laws are as yet hidden from us, and much regarding them is but imperfectly understood. What we do not know is a deal more than what we do know; but to ignore so much as has been discovered, and is well established, and can be learned by any who care to do so, and to go on regardless of it, would indicate a degree of wisdom in the breeder on a par with that of a builder who should fasten together wood and iron just as the pieces happened to come to his hand, regardless of the laws of architecture, and expect a convenient house or a fast-sailing ship to be the result of his labors.

Is not the usual course of procedure among many farmers too nearly parallel to the case supposed? Let the ill-favored, chance-bred, mongrel beasts in their barnyards testify. The truth is, and it is of no use to deny or disguise the fact—the *improvement* of domestic animals is one of the most important, and, to a large extent, one of the most neglected branches of rural economy. The fault is not that farmers do not keep stock enough; oftener they keep more than they can feed to the most profitable point, but the majority neither bestow proper care upon the selection of animals for breeding, nor do they appreciate the dollars and cents difference between such as are profitable and such as are profitless. How many will hesitate to pay a dollar for the services of a good bull when some sort of a calf can be gotten for a "quarter?" and this, too, when one by the good male would be worth a dollar more for veal and ten or twenty dollars more when grown to a cow or an ox. How few refuse to allow to a butcher the cull of his calves and lambs for a few extra shillings, and this when the butcher's difference in shillings would soon, were the best kept and the worst sold, grow into as many dollars and more? How many there are who esteem size to be of more consequence than symmetry, or adaptation to

the use for which they are kept? How many ever sit down to calculate the difference in money value between an animal which barely pays for keeping, or perhaps not that, and one which pays a profit? Let us reckon a little. Suppose a man wishes to buy a cow. Two are offered him, both four years old, and which might probably be serviceable for ten years to come. With the same food and attendance, the first will yield for ten months in the year an average of five quarts per day, and the other for the same term will yield seven quarts and of equal quality. What is the comparative value of each? The difference in yield is six hundred quarts per annum. For the purpose of this calculation we will suppose it worth three cents per quart, amounting to eighteen dollars. Is not the second cow, while she holds out to give it, as good as the first, and three hundred dollars at six per cent. interest besides? If the first just pays for her food and attendance, the second, yielding two-fifths more, pays *forty per cent. profit* annually; and yet how many farmers having two such cows for sale would make more than ten, or twenty, or, at most, thirty dollars difference in the price? The profit from one is eighteen dollars a year; in ten years, one hundred and eighty dollars, besides the annual accumulations of interest. The profit of the other is nothing. If the seller has need to keep one, would he not be wiser to give away the first than to part with the second for a hundred dollars? Suppose, again, that an acre of grass or a ton of hay cost five dollars, and that for its consumption by a given set of animals the farmer gets a return of five dollars' worth of labor, or meat, or wool, or milk. He is selling his crop at cost, and makes no profit. Suppose by employing other animals, better horses, better cows, oxen, and sheep, he can get ten dollars per ton in return. How much are the latter worth more than the former? Have they not doubled the value of the crops, and increased the profit of farming from nothing to a hundred per cent? Except that the manure is not doubled, and the animals would some day need to be replaced, could he not as well afford to give the price of his farm for one set as to accept the other as a gift? Among many who are, in fact, ignorant of what goes to constitute merit in a breeding animal, there is an inclination to treat as imaginary and unreal the higher values placed upon well-bred animals over those of mixed origin, unless they are larger and handsomer in proportion to the price demanded. The sums paid for qualities which are not at once apparent to the eye are stigmatized as *fancy prices*. It is not denied that fancy prices are sometimes, perhaps often, paid, for there are probably few who are not willing occasionally to pay for what pleases them, aside from any other merit commensurate to the price. But, on the other hand, it is fully as true that great intrinsic value for breeding purposes may exist in an animal and yet make very little show. Such a one may not even look so well to a casual observer as a grade, or cross-bred animal, which, although quite as valuable to the grazier or butcher, is not, for breeding purposes, worth a tenth part as much.

Let us suppose two farmers to need a bull. They go to seek, and two are offered, both two years old, of similar color, form, and general appearance. One is offered for twenty dollars; for the other a hundred is demanded. Satisfactory evidence is offered that the latter is no better than any or all of its ancestors for many generations back on both sides, or than its kindred; that it is of a pure and distinct breed; that it possesses certain well-known hereditary qualities; that it is suited for a definite purpose; it may be a short-horn, justly noted for large size and early maturity; it may be a Devon, of fine color and symmetry, active and hardy; it may be an Ayrshire, esteemed for dairy qualities, or of some other definite breed, whose uses, excellencies, and deficiencies are all well known. The other is of no breed whatever. The man who bred it had rather confused ideas, so far as he had any, about breeding, and thought to combine all sorts of good qualities in one animal, and so he worked in a

little grade Durham, or Hereford, to get size, and a little Ayrshire for milk, and a little Devon for color, and so on, incorporating also a good share of the "native" element in his stock, because "it was tough, and some folks thought natives were the best after all." Among its ancestors and kindred were some good and some not good, some large and some small, some well-favored and fat, some ill-favored and lean, some profitable and some profitless. The animal now offered is a great deal better than the average of them. It looks, for aught they can see, about as well as the one for which five times his price is asked Perhaps he served forty cows last year, and brought his owner as many quarters, while the other only served five. The question arises, which is the better bargain?

After pondering the matter, one buys the low-priced and the other the high-priced one, both being well satisfied in their own minds. What did results show? The low-priced one served that season perhaps a hundred cows; more than ought to have done so came a second time. Having been overtasked as a yearling, he lacked somewhat of vigor. The calves came of *all sorts*—some good, some poor, a few like the sire, more like the dams—all mongrels, and showing mongrel origin more than he did. There seemed in many of them a tendency to combine the defects of the grades from which he sprung rather than their good points. In some, the quietness of the short-horn seemed to have degenerated into stupidity, and in others the activity of the Devon into nervous viciousness. Take them together, they perhaps paid for rearing, or nearly so. After using him another year, he was killed, having been used long enough. The other, we will say, served that same season a reasonable number—perhaps, four to six in a week, or one every day—not more. Few came a second time, and those for no fault of his. The calves bear a striking resemblance to the sire. Some from the better cows look even better in some points than himself, and few much worse. There is a remarkable uniformity among them; as they grow up they thrive better than those by the low-priced one. They prove better adapted to the use intended. On the whole, they are quite satisfactory, and each pays annually in its growth, labor, or milk, a profit over the cost of food and attendance, of five or ten dollars or more. If worked enough to furnish the exercise needful to insure vigorous health, and no harm befalls him, the bull may be as serviceable and as manageable at eight or ten years old as at two; meantime he has got, perhaps, five hundred calves, which in due time become worth ten or twenty dollars each more than those from the other. Which now seems the wiser purchase? Was the higher estimate placed on the well-bred animal based upon fancy or upon intrinsic value?

LAW OF SIMILARITY.

The first and most important among the laws which govern hereditary transmission is the one already referred to, viz: that of similarity. It is, by virtue of this law that the peculiar characters, qualities, and properties of the parents, whether external or internal, good or bad, healthy or diseased, are transmitted to their offspring. This is one of the plainest and most certain of the laws of nature. Children resemble their parents, and they do so because these are hereditary. The law is constant. Within certain limits progeny always and everywhere resemble their parents. If this were not so, there would be no constancy of species, and a horse might beget a calf, or a sow have a litter of puppies, which is never the case; for in all time we find repeated in the offspring the structure, the instincts, and the general characteristics of the parents, and never those of another species. Such is the law of nature, and hence the axiom that "like produces like." But while experience teaches the constancy of hereditary transmission, it teaches, just as plainly, that the constancy is not absolute and perfect; and this introduces us to another law, viz: that of varia-

tion, which will be considered by and by; our present concern is to ascertain what we can of the law of similarity.

The lesson which this law teaches might be stated in five words, to wit: *Breed only from the best;* but the teaching may be more impressive, and will more likely be heeded, if we understand the extent and scope of the law. Facts in abundance show the hereditary tendency of physical, mental, and moral qualities in men, and very few would hesitate to admit that the external form and general characteristics of parents descend to children in both the human and brute races, but not all are aware that this law reaches to such minute particulars as facts show to be the case.

We see hereditary transmission of a peculiar type, upon an extensive scale, in some of the distinct races—the Jews and the gypsies for example. Although exposed for centuries to the modifying influences of diverse climates, to an association with peoples of widely differing customs and habits, they never merge their peculiarities in those of any people with whom they dwell, but continue distinct. They retain the same features, the same figures, the same manners, customs, and habits. The Jew in Poland, in Austria, in London, or in New York, is the same; and the money-changers of the temple at Jerusalem in the time of our Lord may be seen to-day "on 'change" in any of the larger marts of trade. How is this? Just because the Jew is a "thorough-bred." There is with him no intermarriage with the Gentile—no crossing, no mingling of his organization with that of another. When this ensues "permanence of race" will cease, and give place to variations of any or of all sorts.

Some families are remarkable during long periods for tall and handsome figures and striking regularity of features, while in others a less perfect form, or some peculiar deformity reappears with equal constancy. A family in Yorkshire is known for several generations to have been furnished with six fingers and toes. A family possessing the same peculiarity resides in the valley of the Kennebec, and the same has reappeared in one or more other families connected with it by marriage. The thick upper lip of the imperial house of Austria, introduced by the marriage of the Emperor Maximilian with Mary of Burgundy, has been a marked feature in that family for hundreds of years, and is visible in their descendants to this day. Equally noticeable is the "Bourbon nose" in the former reigning family of France. All the Barons de Vessius had a peculiar mark between their shoulders, and it is said that by means of it a posthumous son of a late Baron de Vessius was discovered in a London shoemaker's apprentice. Haller cites the case of a family where an external tumor was transmitted from father to son, which always swelled when the atmosphere was moist. The famous English horse Eclipse had a mark of a dark color on his quarter, which, although not a defect, was transmitted to his progeny even to the fifth generation. Very curious are the facts which go to show that acquired habits sometimes become hereditary. Pritchard, in his "Natural History of Man," says that the horses bred on the table lands of the Cordilleras "are carefully taught a peculiar pace, which is a sort of running amble;" that after a few generations this pace becomes a natural one, young, untrained horses adopting it without compulsion. But a still more curious fact is, that if these domesticated stallions breed with mares of the wild herd which abound in the surrounding plains, they "become the sires of a race in which the ambling pace is natural and requires no teaching." Mr. T. A. Knight, in a paper read before the Royal Society, says:

> "The hereditary propensities of the offspring of Norwegian ponies, whether full or half-bred, are very singular. Their ancestors have been in the habit of *obeying the voice* of their riders and *not the bridle*, and horse-breakers complain that it is impossible to produce this last habit in the young colts. They are, however, exceedingly docile and obedient when they understand the commands of their masters."

If, even in such minute particulars as these, hereditary transmission may be

distinctly seen, it becomes the breeder to look closely to the "like" which he wishes to see reproduced. Judicious selection is indispensable to success in breeding, and this should have regard to *every particular*—general appearance, length of limb, shape of carcass, development of chest; if in cattle, the size, shape, and position of udder, thickness of skin, "touch," length and texture of hair, docility, &c., &c.; if in horses, their adaptation to any special excellence depending on form, or temperament, or nervous energy. Not only should care be taken to avoid *structural defects*, but especially to secure freedom from *hereditary diseases*, as both defects and diseases appear to be more easily transmissible than desirable qualities. Hereditary diseases not unfrequently have their origin in some faulty or peculiar conformation. Thus horses most disposed to spavins are those having short-pointed hocks, deficient in width and breadth below, and disproportionately small compared with the upper portion of the joint. Those most disposed to ringbones are horses with upright pasterns and high action, &c. On the other hand, there is often no obvious peculiarity of structure, or appearance, indicating the possession of diseases or defects which are transmissible, and so special care and continued acquaintance are necessary in order to be assured of their absence in breeding animals; but such a tendency, although invisible or inappreciable to cursory observation, must still, judging from its effects, have as real and certain existence as any peculiarity of form or color. Hereditary diseases are transmitted by either parent, and are doubly severe when both are affected. They are developed, not only in the immediate progeny, but often also in subsequent ones; occasionally the tendency remains latent through one or two generations, and afterwards breaks out again as severely as at first. The diseases which are found to be hereditary in horses are scrofula, rheumatism, rickets, chronic cough, roaring, ophthalmia, or inflammation of the eye, grease or scratches, bone spavin, curb, &c. Indeed, Youatt says: "There is scarcely a malady to which the horse is subject that is not hereditary. Contracted feet, curb, spavin, roaring, thick wind, blindness, notoriously descend from the sire or dam to the foal." The diseases which are found hereditary in neat cattle are scrofula, consumption, dysentery, diarrhœa, rheumatism, and malignant tumors. Neat cattle being less exposed to the exciting causes of diseases, and less liable to be overtasked or exposed to violent changes of temperature, or otherwise put in jeopardy, their diseases are not so numerous, and what they have are less violent than in the horse, and generally of a chronic character.

Scrofula is not uncommon among sheep; they are also liable to diseases of the brain and of the respiratory and digestive organs. Epilepsy, or "fits," and rheumatism, sometimes occur. Swine are subject to nearly the same hereditary diseases as sheep. Epilepsy is more common with them than with the latter, and they are more liable to scrofula than any other domestic animals. With regard to hereditary diseases, it is eminently true that "an ounce of prevention is worth a pound of cure." As a general and almost invariable rule, animals possessing either defects or a tendency to disease should not be employed for breeding. If, however, for special reasons, it seems desirable to breed from one which has some slight defect of symmetry, or a faint tendency to disease, (although for the latter it is doubtful if the possession of any good qualities can fully compensate,) it should be mated with one which excels in every respect in which the other is deficient, and on no account with one which is near of kin to it.

THE LAW OF VARIATION.

We come, now, to consider another law, by which that of similarity is greatly modified, to wit: the law of variation or divergence. All organized beings, whether plants or animals, possess a certain flexibility or pliancy of organization, rendering them capable of change to a greater or less extent. When in a

state of nature variations are comparatively slow and infrequent, but when in a state of domestication they occur much oftener and to a much greater extent. The greater variability in the latter case is doubtless owing, in some measure, to our domestic productions being reared under conditions of life not so uniform and different from those to which the parent species was exposed in a state of nature.

Flexibility of organization, in connexion with climate, is seen in a remarkable degree in Indian corn. The small Canada variety, growing only three feet high, and ripening in seventy to ninety days, when carried southward gradually enlarges in the whole plant until it may be grown twelve feet high and upwards, and requires one hundred and fifty days to ripen its seed. A southern variety brought northward gradually dwindles in size, and ripens earlier until it reaches a type specially fitted to its latitude. Variation, although the same in kind, is greater in degree among domesticated plants than among animals. From the single wild variety of the potato, as first discovered and taken to Europe, have sprung innumerable sorts. From the insignificant plant known to botanists as *Brassica oleracea* have been produced, by cultivation, all the varieties of cabbages, kails, broccolis, cauliflowers, and turnips; also the Brussels sprouts, the rape plant, and the kohl rabi. In brief, it may be said that nearly or quite all the choicest productions both of our kitchen and flower gardens are due to variations induced by cultivation in a course of years from plants which, in their natural condition, would scarcely attract a passing glance.

We cannot say what might have been the original type of many of our domestic animals, for the inquiry would carry us beyond any record of history or tradition regarding it; but few doubt that all our varieties of the horse, the ox, the sheep, and the dog, sprang each originally from a single type, and that the countless variations are due to causes connected with their domestication. Of those reclaimed within the period of memory may be named the turkey. This was unknown to the inhabitants of the old continent until discovered here in a wild state. Since then, having been domesticated and widely disseminated, it now offers varieties of wide departure from the original type, and which have been nurtured into self-sustaining breeds, distinguished from each other by the possession of peculiar characteristics.

Among what are usually reckoned the more active causes of variation may be named *climate, food,* and *habit.*

Animals in cold climates are provided with a thicker covering of hair than in warmer ones. Indeed, it is said that in some of the tropical provinces of South America there are cattle which have an extremely rare and fine fur in place of the ordinary pile of hair. Various other instances could be cited, if necessary, going to show that a beneficent Creator has implanted, in many animals, to a certain extent a *power of accommodation* to the circumstances and conditions amid which they are reared. The *supply of food,* whether abundant or scanty, is one of the most active causes of variation known to be within the control of man. For illustration of its effect let us suppose two pairs of twin calves, as nearly alike as possible, and let a male and a female from each pair be suckled by their mothers until they wean themselves, and be fed always after with plenty of the most nourishing food; and the others to be fed with skimmed milk, hay tea, and gruel, at first, to be put to grass at two months old, and subsequently fed on coarse and innutritious fodder. Let these be bred from separately, and the same style of treatment kept up, and not many generations would elapse before we had distinct varieties or breeds, differing materially in size, temperament, and time of coming to maturity.

Suppose other similar pairs, and one from each to be placed in the richest blue-grass pastures in Kentucky, or in the fertile valley of the Tees, always supplied with abundance of rich food. These live luxuriously, grow rapidly,

increase in height, bulk, thickness, every way; they early reach the full size which they are capable of attaining; having nothing to induce exertion, they become inactive, lazy, lethargic, and fat. Being bred from, the progeny resemble the parents, "only more so." Each generation acquiring more firmly and fixedly the characteristics induced by their situation, these become hereditary, and we, by and by, have a *breed* exhibiting somewhat of the traits of the Teeswater or Durhams, from which the improved short-horns of the present day have been reared. The others we will suppose to have been placed on the hill-sides of New England, or on the barren isle of Jersey, or on the highlands of Scotland, or in the pastures of Devonshire. These being obliged to roam longer for a scantier repast, grow more slowly, develop their capabilities in regard to size not only more slowly, but, perhaps, not fully at all. They become more active in temperament and habit, thinner and flatter in muscle. Their young cannot so soon shift for themseves, and require more milk, and the dams yield it. Each generation in its turn becomes more fully and completely adapted to the circumstances amid which they are reared; and, if bred indiscriminately with anything and everything else, we, by and by, have the common mixed cattle of New England, miscalled natives; or, if kept more distinct, we have something approaching the Devon, the Ayrshire, or the Jersey breeds.

A due consideration of the natural effect of climate and food is a point worthy the special attention of the stock husbandman. If the breeds employed be well adapted to the situation, and the capacity of the soil is such as to feed them fully, profit may be safely calculated upon. Animals are to be looked upon as machines for converting herbage into money. Now, it costs a certain amount to keep up the motive power of any machine, and also to make good the wear and tear incident to its working; and in the case of animals it is only so much as is digested and assimilated *in addition* to the amount thus required which is converted into meat, milk, or wool, so that the greater the proportion which the latter bears to the former, the greater will be the *profit* to be realized from keeping them.

In many sections there exists a preference for cattle of large size; and if they possess symmetry and all other good qualities commensurate with the size, and if plenty of nutritious food can be supplied, there is an advantage gained by keeping such, for it costs less, *other things being equal,* to shelter and care for one animal than for two. But if the pastures and meadows be not of the richest, and we select such as require, in order to give the profit which they are capable of yielding, more or richer food than our farms can supply, or than we have the means to purchase, we must necessarily fail to reap as much profit as we might by the selection of such as could be easily fed upon home resources to the point of highest profit. Whether the selection be of such as are either larger or smaller than suit our situation, they will, and equally in both cases, vary by degrees towards the fitting size or type for the locality in which they are kept; but there is this noteworthy difference, that if larger ones be brought in, they will not only diminish, but deteriorate, while, if smaller be brought in, they will enlarge *and improve.* The bestowal of food sufficient both in amount and quality to enable animals to develop all the excellencies inherent in them, and to obtain all the profit to be derived from them, is something very distinct from undue forcing or pampering. This process may produce wonderful animals to look at, but neither useful nor profitable ones, and there is danger of thus producing a most undesirable variation; for, as in plants, we find that forcing, pampering, high culture, or whatever else it may be called, may be carried so far as to result in the production of double flowers, (an unnatural development,) and these accompanied with greater or less inability to perfect seed; so in animals the same process may be carried far enough to produce sterility.

Impotency in bulls of various breeds has not unfrequently occurred from too high feeding, and especially if connected *with lack of sufficient exercise.**

Habit has a decided influence towards inducing variation. As the blacksmith's right arm becomes more muscular from the habit of exercise induced by his vocation, so we find in domestic animals that use, or the demand created by habit, is met by a development or change in the organization adapted to the requirement. For instance, with cows in a state of nature, or where required only to suckle their young, the supply of milk is barely fitted to the requirement. If more is desired, and if the milk be drawn completely and regularly, the yield is increased and continued longer. By keeping up the demand there is induced in the next generation a greater development of the secreting organs, and more milk is given. By continuing the practice, by furnishing the needful conditions of suitable food, &c., and by selecting in each generation those animals showing the greatest tendency towards milk, a breed specially adapted for the dairy may be established. It is just by this mode that the Ayrshires have in the past eighty or a hundred years been brought to be what they are—a breed giving more good milk upon a given quantity of food than any other.

It is because the English breeders of modern short-horns generally prefer beef-making to milk-giving properties that they have fostered variation in favor of the one at the expense of the other, until the milk-giving quality in some families is nearly bred out. It was not so formerly. Thirty years ago the short-horns, (or, as they were then usually called, the Durhams,) were not deficient in dairy qualities, and some families were famous for large yield. By properly directed efforts they might, doubtless, be bred back to milk; but of this there is no probability, at least in England, for the tendency of modern practice is very strong towards having each breed specially fitted to its use—the dairy breeds for milk, and the beef breeds for meat only. Climate, food, and habit are the principal causes of variation which are known to be in any marked degree under the control of man, and the effect of these is, doubtless, in some measure, indirect, and subservient to other laws of reproduction, growth, and inheritance, of which we have at present very imperfect knowledge. This is shown by the fact that the young of the same litter sometimes differ considerably from each other, though both the young and their parents have apparently been exposed to exactly the same conditions of life; for had the action of these conditions been specific or direct, and, independent of other laws, if any of the young had varied, the whole would probably have varied in the same manner. Numberless hypotheses have been started to account for variation. Some hold that it is as much the function of the reproductive system to produce individual differences as it is to make the child like the parents. Darwin says: "The reproductive system is eminently susceptible to changes in the conditions of life; and to this system being functionally disturbed in the parents I chiefly attribute the varying or plastic condition of the offspring. The male and female sexual elements seem to be affected before that union takes place which is to form a new being. But why, because the reproductive system is disturbed this or that part should vary more or less we are profoundly ignorant. Never'

* A *working bull*, though, perhaps, not so pleasing to the eye as a fat one, (for fat sometimes covers a multitude of defects,) is a surer stock-getter, and his progeny is more likely to inherit full health and vigor. Another cause of impotency, sometimes temporary and sometimes by neglect becoming permanent, deserves mention. Bulls are liable to an inflammatory disease arising from connexion with cows which have been lately driven far or violently exercised. Such cows should not be served until cooled down and comparatively quiet. If the bull has taken the disease, he should be kept from breeding for a while, the parts washed and fomented, and some cooling medicine given. There is also reason to believe that bulls may either contract disease, or the ability to convey the germs of disease *from aborting cows*, so as to induce abortion in other cows subsequently served by him.

theless, we can here and there dimly catch a faint ray of light, and we may feel sure that there must be some cause for each deviation of structure, however slight." It may be useless for us to speculate here upon the laws which govern variations. The fact that these exist is what the breeder has to deal with, and a most important one it is, for it is this chiefly which makes hereditary transmission the problem which it is. His aim should ever be *to grasp and render permanent, and increase so far as practicable, every variation for the better, and to reject for breeding purposes such as show a downward tendency.* Among the "faint rays" alluded to by Mr. Darwin as throwing light upon the changes dependent on the laws of reproduction there is one, perhaps the brightest yet seen, which deserves our notice. It is the apparent influence of the male first having fruitful intercourse with a female upon her subsequent offspring by other males. Attention was first directed to this by the following circumstances, related by Sir Edward Home: A young chestnut mare, seven-eighths Arabian, belonging to the Earl of Morton, was covered in 1815 by a quagga, a species of wild ass from Africa, and marked somewhat in the style of a zebra. The mare was covered but once by the quagga, and after a pregnancy of eleven months and four days gave birth to a hybrid, which had, as was expected, distinct marks of the quagga in the shape of its head, black bars on the legs and shoulders, &c. In 1817, 1818, and 1821, the same mare was covered by a very fine black Arabian horse, and produced successively three foals, and, although she had not seen the quagga since 1816, they all bore his curious and unequivocal markings. Since the occurrence of this case numerous others of a similar character have been observed, a few of which may be mentioned. Mr. McGillivray says: "That in several foals in the royal stud at Hampton Court, got by the horse "Actæon," there were unmistakable marks of the horse "Colonel." The dams of these foals were bred from by "Colonel" the previous year. A colt, the property of the Earl of Sheffield, got by "Laurel," so resembled another horse, "Camel," that it was whispered and even asserted at Newmarket that he must have been got by "Camel." It was ascertained, however, that the mother of the colt bore a foal the previous year by "Camel." Alexander Morrison, esq., of Bognie, had a fine Clydesdale mare which, in 1843, was served by a Spanish ass, and produced a mule. She afterwards had a colt by a horse which bore a very marked likeness to a mule—seen at a distance every one sets it down at once as a mule. The ears are nine and one-half inches long, the girth not quite six feet, stands above sixteen hands high. The hoofs are so long and narrow that there is a difficulty in shoeing them, and the tail is thin and scanty. He is a beast of indomitable energy and durability, and highly prized by his owner. A pure Aberdeenshire heifer, the property of a farmer in Forgue, was served with a pure Teeswater bull, to which she had a fine cross calf. The following season the same cow was served with a pure Aberdeenshire bull; the produce was in appearance a cross-bred calf, which at two years old had long horns; the parents were both hornless. A small flock of ewes belonging to Dr. W. Wells, in the island of Grenada, were served by a ram procured for the purpose. The ewes were all white and woolly; the ram was quite different—of a chocolate color, and hairy, like a goat. The progeny were, of course, crosses, but bore a strong resemblance to the male parent. The next season Dr. Wells obtained a ram of precisely the same breed as the ewes, but the progeny showed distinct marks of resemblance to the former ram in color and covering. The same thing occurred on neighboring estates, under like circumstances. Numerous other instances might be stated, both of those recorded by others and of those within the sphere of my own observation, if space would permit, some of which are given in the work alluded to in the note on the first page of this paper. Not a few might also be given showing that the same rule holds in the human species, of which a single one will suffice here: "A young woman residing in Edinburg, and born of white parents, but whose mother

previous to her marriage bore a mulatto child by a negro man servant, exhibits distinct traces of the negro. Dr. Simpson, whose patient at one time the young woman was, recollects being struck with the resemblance, and noticed particularly that the hair had the qualities characteristic of the negro." Dr. Carpenter, in the last edition of his work on physiology, says it is by no means an unfrequent occurrence for a widow who has married again to bear children resembling her first husband. Various explanations have been offered to account for the facts observed, among which the theory of Mr. McGillivray, veterinary surgeon, which is indorsed by Dr. Harvey, and considered as very probable, at least, by Dr. Carpenter, seems the most satisfactory. Dr. Harvey says: "Instances are sufficiently common among the lower animals where the offspring exhibit more or less distinctly, over and beyond the characters of the male by which they were begotten, the peculiarities also of a male by which their mother at some former period had been impregnated. * * * Great difficulty has been felt by physiological writers in regard to the proper explanation of this kind of phenomena. They have been ascribed by some to a permanent impression made somehow by the semen of the first male on the genital, and more particularly on the ova of the female; and by others to an abiding influence exerted by him on the imagination, and operating at the time of her connexion subsequently with other males, and perhaps during her pregnancy; but they seem to be regarded by most physiologists as inexplicable."

Very recently, in a paper published in the "Aberdeen Journal," a veterinary surgeon, Mr. James McGillivray, of Huntley, has offered an explanation which seems to me to be the true one. His theory is, that "*when a pure animal of any breed has been pregnant to an animal of a different breed, such pregnant animal is a cross ever after, the purity of her blood being lost in consequence of her connexion with the foreign animal, herself becoming a cross forever, incapable of producing a pure calf of any breed.*" Dr. Harvey believes "that while, as all allow, a portion of the mother's blood is continually passing by absorption and assimilation into the body of the fœtus in order to its nutrition and development, a portion of the blood of the fœtus is as constantly passing in like manner into the body of the mother; that as this commingles there with the general mass of the mother's own blood, it innoculates her system with the constitutional qualities of the fœtus; and that, as these qualities are in part derived to the fœtus from the male progenitor, the peculiarities of the latter are thereby so ingrafted on the system of the female as to be communicable by her to any offspring she may subsequently have by other males."

In support of this view, Mr. McGillivray cites a case in which there was presented unmistakable evidence that the organization of the placenta admits the return of the Venus blood to the mother; and Dr. Harvey, with much force, suggests that the effect produced is analogous to the known fact that constitutional syphilis has been communicated to a female who never had any of the primary symptoms. Regarding the occurrence of such phenomena, Dr. Harvey, under a later date, says: "Since then I have learned that many among the agricultural body in this district are familiar, to a degree that is annoying to them, with the facts then adduced in illustration of it, finding that after breeding crosses, their cows, though served with bulls of their own breed, yield crosses still, or rather mongrels; that they were already impressed with the idea of contamination of blood as the cause of the phenomenon; that the doctrine so intuitively commended itself to their minds as soon as stated; that they fancied they were told nothing but what they knew before, so just is the observation that truth proposed is much more easily perceived than without such proposal is it discovered." In the absence of more general and accurate observations directed to this point, it is impossible to say to what extent the first male produces an impression upon subsequent progeny by other males. There can be no doubt, however, but that some impression is made.

The instances where it is of so marked and obvious a character, as in some of those just related may be comparatively few, yet there is reason to believe that although in a majority of cases the effect may be less noticeable, it is not less real, and demands the careful attention of all breeders. Whether this result is to be ascribed to innoculation of the system of the female with the characteristics of the male through the fœtus, or to any other mode of operation, it is obviously of great advantage for every breeder to know it, and thereby both avoid error and loss and secure profit. It is a matter which deserves thorough investigation, and the observations should be minute and have regard not only to peculiarities of form, but also to qualities and characteristics not so obvious; for instance, there may be greater or less hardiness, endurance, or aptitude to fatten. These may be usually more dependent on the dam, but the male is never without a degree of influence upon them; and it is well established that aptitude to fatten is usually communicated by the short-horn bull to crosses with cattle of mixed or mongrel origin, which are often very deficient in this desirable property. A knowledge of this law gives us a clue to the cause of many of the disappointments of which practical breeders often complain, and to the cause of many variations otherwise unaccountable, and suggests particular caution as to the first male employed in the coupling of animals—a matter which has often been deemed of little consequence in regard to cattle, inasmuch as fewer heifers' first calves are reared than of such as are borne subsequently.

ATAVISM, OR ANCESTRAL INFLUENCE.

It may not be easy to say whether this phenomenon is more connected with the law of similarity or with that of variation. Youatt speaks of it as showing the universality of the application of the axiom that "like produces like;" that when this "may not seem to hold good, it is often because the lost resemblance to generations gone by is strongly revived." The phenomenon, or law, as it is sometimes called, of atavism,* or ancestral influence, is one of considerable practical importance and well deserves attention. Every one is aware that it is nothing unusual for a child to resemble its grandfather or grandmother, or some ancestor still further back, more than it does either its own father or mother. The fact is too familiar to require the citing of examples. We find the same occurrence among our domestic animals, and oftener in proportion as the breeds are crossed or mixed up. Among our common cattle, (*natives* as they are often miscalled,) originating, as they have done, from animals brought from England, Scotland, Denmark, France, and Spain, each possessing different characteristics of form, color, and use, and bred indiscriminately together, with no special point in view, no attempt to obtain any particular type or form, or to secure adaptation for any particular purpose, we have very frequent opportunities of witnessing the results of the operation of this law of hereditary transmission. So common is its occurrence that the remark is often made that, however good a cow may be, there is no telling beforehand what sort of a calf she may have. The fact is sufficiently obvious that certain peculiarities often lie dormant for a generation or two and then reappear in subsequent progeny. Stock-men often speak of it as "breeding back" or "crying back." The cause of this phenomenon we may not fully understand. A late writer says, "it is to be explained on the supposition that the qualities were transmitted by the grandfather to the father, in whom they were *masked* by the presence of some antagonistic or controlling influence, and were thence transmitted to the son, in whom, the antagonistic influence being withdrawn, they manifest themselves."

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* From the Latin *atavus*, meaning any ancestor indefinitely, as a grandmother's great grandfather.

A French writer on physiology says, if there is not inheritance of paternal characteristics, there is at least an *aptitude* to inherit them, a disposition to reproduce them; and there is always a transmission of this aptitude to some new descendants, among whom these traits will manifest themselves sooner or later. Mr. Singer, let us say, has a remarkable aptitude for music, but the influence of Mrs. Singer is such that their children, inheriting her imperfect ear, manifest no musical talent whatever. These children, however, have inherited the disposition of the father in spite of its non-manifestation; and if, when they transmit what in them is latent, the influence of their wives is favorable, the grandchildren may turn out musically gifted. The lesson taught by the law of atavism is very plain. It shows the importance of seeking "thorough-bred" or "well-bred" animals; and by these terms are simply meant such as are descended from a line of ancestors in which, for many generations, the desirable forms, qualities, and characteristics have been *uniformly shown*. In such a case, even if ancestral influence does come in play, no material difference appears in the offspring, the ancestors being all essentially alike. From this stand-point we best perceive in what consists the money value of a good "pedigree." It is in the evidence which it brings that the animal is descended from a line all the individuals of which were alike and excellent of their kind, and so is almost sure to transmit like excellencies to its progeny in turn; not that every animal, with a long pedigree, full of high-sounding names, is necessarily of great value as a breeder, for in every race or breed, as we have seen while speaking of the law of variation, there will be here and there some which are less perfect and symmetrical of their kind than others; and if such be bred from, they may, likely enough, transmit undesirable points; and if they be mated with others possessing similar failings, they are almost sure to deteriorate very considerably. Pedigree is valuable in proportion as it shows an animal to be descended, not only from such as are purely of its own race or breed, but also from such individuals in that breed as were specially noted for the excellencies for which that particular breed is esteemed. Weeds are none the less worthless because they appear among a crop consisting chiefly of valuable plants; nor should deformed or degenerate plants, although they be true to their kind, ever be employed to produce seed. The pertinacity with which hereditary traits cling to the organization in a latent, masked, or undeveloped condition for long after they might be supposed to be wholly "bred out" is sometimes very remarkable. What is known among breeders of short-horns as the "Galloway Alloy," although originating by the employment for only once of a single animal of a different breed, is said to be traceable, even now, after many years, in the occasional development of a "smutty nose" in descendants of that family.

Many years ago there were in the Kennebec valley a few polled or hornless cattle. They were not particularly cherished, and gradually diminished in numbers. Mr. Payne Wingate shot the last animal of this breed, (a bull calf or a yearling,) mistaking it in the dark for a bear. During thirty-five years subsequently all the cattle upon his farm had horns, but at the end of that time one of his cows produced a calf which grew up without horns, and Mr. Wingate said it was, in all respects, the exact image of the first bull of the breed brought there. Probably the most familiar exemplification of clearly marked ancestral influence is to be found in ill-begotten, round-breeched calves, occasionally, and not very unfrequently, dropped by cows of the common, mixed kind, and which if killed early make very blue veal, and if allowed to grow up become exceedingly profitless and unsatisfactory beasts; the heifers being often sterile, the cows poor milkers, the oxen dull, mulish beasts, yielding flesh of dark color, ill flavor, and destitute of fat. They are known by various names in different localities, as the "Peter Waldo," "Yorkshire," "Westminster," "Pumpkin Buttocks," &c., &c. It is probable that this peculiarity

was first introduced into America by means of some of the early importations of Dutch cattle, or of the old Durham or Teeswater breed. No one who has proved the worthlessness of these cattle would willingly believe that any bull of this sort had been lately kept for service, and yet it is by no means a rare occurrence to find calves dropped at the present time bearing unmistakable evidence of distant ancestral influence.

RELATIVE INFLUENCE OF THE PARENTS.

The relative influence of the male and female parents upon the characteristics of progeny has long been a fertile subject of discussion among breeders. It is found in experience that progeny sometimes resembles one parent more than the other; sometimes there is an apparent blending of the characteristics of both; sometimes a noticeable dissimilarity to either, though always more or less resemblance somewhere; and sometimes the impress of one may be seen upon a portion of the organization of the offspring, and that of the other parent upon another portion; yet we are not authorized from such discrepancies to conclude that it is a matter of chance, for all of Nature's operations are conducted by fixed laws, whether we be able fully to discover them or not. The same causes always produce the same results. In this case not less than in others there are, beyond all doubt, fixed laws, and the varying results which we see are easily and sufficiently accounted for by the existence of conditions or modifying influences not fully patent to our observation.

In the year 1825 the Highland Society of Scotland proposed, as the subject of prize essays, the solution of the question, "Whether the breed of live stock connected with agriculture be susceptible of the greatest improvement from the qualities conspicuous in the male or from those conspicuous in the female parent?" Four essays received premiums. Mr. Boswell, one of the prize writers, maintained that it is not only the male parent which is capable of most speedily improving the breed of live stock, but that the male is the parent which we can alone look to for improvement. His paper is of considerable length and ably written, abounding in argument and illustrations not easily condensed so as to be given here, and it is but justice to add that he also holds that "before the breed of a country can be improved, much more must be looked to than the answer to the question put by the Highland Society, such as crossing, selection of both parents, attention to pedigree, and to the food and care of offspring." Mr. Christian, in his essay, supports the view that the offspring bears the greatest resemblance to that parent, whether male or female, which has exerted the greatest sway of generative influence in the formation of the fœtus; "that any hypothesis which would assign a superiority, or set limits to the influence of either sex in the product of generation, is unsound and inadmissible," and he thus concludes: "As therefore it is unsafe to trust to the qualities of any individual animal, male or female, in improving stock, the best bred and most perfect animals of both sexes should be selected and employed in propagation, there being, in short, no other certain or equally efficacious means of establishing or preserving an eligible breed." Mr. Dallas, in his essay, starts with the idea that the seminal fluid of the male invests the ovum, the formation of which he ascribes to the female; and he supports the opinion that where external appearance is concerned, the influence of the male will be discovered, but in what relates to internal qualities, the offspring will take most from the female. He concludes thus: "When color, quality of fleece, or outward form is wanted, the male may be most depended on for these; but when milk is the object, when disposition, hardiness, and freedom from diseases of the viscera, and, in short, all internal qualities that may be desired, then the female may be most relied on." One of the most valuable of these papers was written by the Rev. Henry Berry, of Worcestershire, in which, after stating that the question proposed is

one full of difficulty, and that the discovery of an independent quality such as that alluded to, in either sex, would be attended with beneficial results, he proceeds to show that it is not to sex, but to high blood, or, in other words, to animals long and successfully selected and bred with a view to particular qualifications, whether in the male or female parent, that the quality is to be ascribed, which the Highland Society has been desirous to assign correctly.

The origin of the prevalent opinion which assigns this power principally to the male he explains by giving the probable history of the first efforts in improving stock. The greatest attention would naturally be paid to the male, both on account of his more extended services and the more numerous produce of which he could become the parent, in consequence of which sires would be well-bred before dams:

"The ideas entertained respecting the useful qualities of an animal would be very similar and lead to the adoption of a general standard of excellence towards which it would be required that each male should approximate, and thus there would exist among what may be termed fashionable sires a corresponding form and character differing from and superior to those of the general stock of the country. This form and character would in most instances have been acquired by *perseverance in breeding from animals which possessed the important or fancied requisites*, and might therefore be said to be almost *confirmed* in such individuals. Under these circumstances, striking results would doubtless follow the introduction of these sires to a common stock—results which would lead superficial observers to remark that individual sires possessed properties as *males*, which in fact were only assignable to them as *improved* animals."

The opinion entertained by some that the female possesses the power generally ascribed to the male he explains, also, by a reference to the history of breeding:

"It is well known to persons conversant with the subject of improved breeding that of late years numerous sales have taken place of the entire stocks of celebrated breeders of sires, and thus the females, valuable for such a purpose, have passed into a great number of hands. Such persons have sometimes introduced a cow so acquired to a bull inferior in point of descent and general good qualities, and the offspring is known, in many instances, to have proved superior to the sire by virtue of the dam's excellence, and to have caused a suspicion in the minds of persons not habituated to compare causes with effects that certain females also possess the property in question."

The writer gives various instances illustrative of his views, in some of which the male only, and in others the female only, was the high-bred animal, in all of which the progeny bore a remarkable resemblance to the well-bred parent. He says that where both parents are equally well-bred, and of nearly equal individual excellence, it is not probable that their progeny will give general proof of a preponderating power in either parent to impress peculiar characteristics upon the offspring; yet in view of all the information we have upon the subject, he recommends a resort to the best males as the most simple and efficacious mode of improving such stocks as require improvement, and the only proceeding by which stock, already good, can be preserved in excellence.

Mon. Giron expresses the opinion that the relative age and vigor of the parents exercise very considerable influence, and states, as the result of his observation, that the offspring of an old male and a young female resembles the father less than the mother, in proportion as the mother is more vigorous and the father more decrepid, and that the reverse occurs with the offspring of an old female and a young male.

Among the more recent theories or hypotheses which have been started regarding the relative influence of the male and female parents, those of Mr. Orton, presented in a paper read before the Farmers' Club at New Castle-upon-Tyne, on the Physiology of Breeding, and of Mr. Walker, in his work on Intermarriage, as they both arrived, to a certain extent, at substantially the same conclusions by independent observations of their own, and, as these seem to agree most nearly with the majority of observed facts, are deemed worthy of favorable mention.

The conclusions of Mr. Orton, briefly stated,* are, that in the progeny there is no casual or haphazard blending of the parts or qualities of the two parents, but rather that organization is transmitted by halves, or that each parent contributes to the formation of certain structures and to the development of certain qualities. Advancing a step further, he maintains that the male parent chiefly determines the external characters, the general appearance, in fact, the outward structure and the locomotive powers of the offspring, as the framework, or bones and muscles, more particularly those of the limbs, the organs of sense and skin; while the female parent chiefly determines the internal structures and the general quality, mainly furnishing the vital organs, *i. e.*, the heart, lungs, glands, and digestive organs, and giving tone and character to the vital functions of secretions, nutrition, and growth, "not, however, that the male is without influence on the internal organs and vital functions, or the female without influence on the external organs and locomotive powers of their offspring. The law holds only within certain restrictions, and these form, as it were, a secondary law, one of limitations, and scarcely less important to be understood than the fundamental law itself." Mr. Orton relies chiefly on the evidence presented by *hybrids*, the progeny of distinct species, or by crosses between the most distinct varieties embraced within a single species, to establish his law.

The examples adduced are chiefly from the former. The *mule* is the progeny of the male ass and the mare; the hinny that of the horse and the she ass. Both hybrids are the produce of the same set of animals. They differ widely, however, in their respective characters—the mule, in all that relates to its external character, having the distinctive features of the ass; the hinny, in the same respects, having all the distinctive features of the horse, while in all that relates to the internal organs and vital qualities, the mule partakes of the character of the horse, and the hinny of those of the ass. Mr. Orton says:

"The mule, the produce of the male ass and mare, is essentially a *modified* ass—the ears are those of an ass somewhat shortened; the mane is that of the ass, erect; the tail is that of an ass; the skin and color are those of an ass somewhat modified; the legs are slender and the hoofs high, narrow, and contracted, like those of an ass. In fact, in all these respects it is an ass somewhat modified. The body and barrel, however, of the mule are round and full, in which it differs from the ass and resembles the mare. The hinny, on the other hand, the produce of the stallion and she ass, is essentially a *modified horse*. The ears are those of a horse somewhat lengthened; the mane flowing; the tail bushy, like that of the horse; the skin is finer, like that of the horse, and the color varies also like the horse; the legs are stronger and the hoofs broad and expanded like those of the horse. In fact, in all these respects it is horse somewhat modified. The body and barrel, however, of the hinny are flat and narrow, in which it differs from the horse and resembles the she ass. A very curious circumstance pertains to the voice of the mule and the hinny. The mule *brays*, the hinny *neighs*. The why and wherefore of this is a perfect mystery, until we come to apply the knowledge afforded us by the law before given. The male gives the locomotive organs, and the muscles are amongst these; the muscles are the organs which modulate the voice of the animal; the mule has the muscular structure of its sire, and brays; the hinny has the muscular structure of its sire, and neighs."

The views of Mr. Walker, in his work on intermarriage, before alluded to, agree substantially with those of Mr. Orton, *so far as regards crossing between different breeds;* but they cover a broader field of observation, and in some respects differ. Mr. Walker maintains that when both parents are of the *same breed*, that *either parent may transmit either half* of the organization; that when they are of *different varieties* or breeds, (and, by parity of reasoning, the same should hold strongly when hybrids are produced by crossing different *species*,) and supposing, also, that both parents are of equal age and vigor, the *male* gives the *back, head, and locomotive organs*, and the *female* the *face* and nutritive organs. I quote his language:

"When both parents are of the same variety, *one parent communicates the anterior part of the head*, *the bony part of the face*, the forms of the *organs of sense*, (the external ear

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* Quoted, in part, from a paper by Alexander Harvey, M. D., read before the Medical Society of Southampton. June 6, 1854.

under lip, lower part of the nose, and eyebrows being often modified,) *and the whole of the internal nutritive system*, (the contents of the trunk or the thoracic and abdominal viscera, and, consequently, the form of the trunk itself, in so far as that depends on its contents.) The resemblance to that parent is, consequently, found in the forehead and bony parts of the face, as the orbits, cheek bones, jaws, chin, and teeth, as well as the shape of the organs of sense and the tone of the voice.

"*The other parent communicates the posterior part of the head, the cerebral situated within the skull immediately above its junction with the back of the neck, and the whole of the locomotive system*, (the bones, ligaments, and muscles, or fleshy parts.) The resemblance to that parent is, consequently, found in the back head, the few more movable parts of the face, as the external ear, under lip, lower part of the nose, eyebrows, and the external forms of the body, in so far as they depend on the muscles, as well as the form of the limbs, even to the fingers, toes, and nails." * * "It is a fact established by my observations that in animals of the *same variety, either the male or the female parent* may give *either series of organs* as above arranged; that is, *either* forehead and organs of sense, together with the vital and nutritive organs, or back head, together with the locomotive organs."

To show that among domesticated animals organization is transmitted by halves in the way indicated, and that either parent may give either series of organs, he cites, among other instances, the account of the Ancon sheep:

"When both parents are of the Ancon or Otter breed, their descendants inherit their peculiar appearance and proportions of form. When an Ancon ewe is impregnated by a common ram, the progeny resembles wholly either the ewe or the ram. The progeny of a common ewe impregnated by an Ancon ram follows entirely in shape the one or the other, without blending any of the distinguishing and essential peculiarities of both. 'Frequent instances have occurred where common ewes have had twins by Ancon rams, when one exhibited the complete marks and features of the ewe, and the other of the ram. The contrast has been rendered singularly striking when one short-legged and one long-legged lamb, produced at a birth, have been sucking the dam at the same time.' As the short and crooked legs, or those of opposite form, here indicate the parent giving the locomotive system, it is evident that one of the twins derived it from one parent, and the other twin from the other parent, the parent not giving it doubtless communicating in each case the vital or nutritive system.'

W. C. Spooner, V. S., says:

"The most probable supposition is that propagation is done by halves, each parent giving to the offspring the shape of one-half of the body. Thus the back, loins, hind-quarters, general shape, skin, and size follow one parent; and the fore-quarters, head, vital and nervous system, the other; and we may go so far as to add that the former, in the great majority of cases, go with the male parent, and the latter with the female."

On the whole, it may be said that the evidence, both from observation and the testimony of the best practical breeders, goes to show that each parent usually contributes certain portions of the organization to the offspring, and that each has a modifying influence upon the other. Facts also show that the same parent does not always contribute the same portions, but that the order is sometimes reversed. Now, as no operation of nature is by accident, but by virtue of *law*, there must be fixed laws here, and there must also be, at times, certain influences at work to modify the action of these laws. Where animals are of distinct species, or of distinct breeds, transmission is usually found to be in accordance with the rule above indicated, *i. e.*, the male gives mostly the outward form and locomotive system, and the female chiefly the interior system, constitution, &c. Where the parents are of the same breed, it appears that the portions contributed by each are governed in large measure by the condition of each in regard to age and vigor, or by virtue of individual potency or superiority of physical endowment. This potency or power of transmission seems to be legitimately connected with high breeding, or the concentration of fixed qualities obtained by continued descent for many generations from such only as possess in the highest degree the qualities desired. On the other hand, it must be admitted that there are exceptional cases not easily accounted for upon any theory, and it seems not improbable that in these the modifying influences may be such as to effect what may approximate a reconstruction or new combination of the elements in a manner analogous to the chemical changes which we know take place in the constituents of vegetables; as, for instance, we find that sugar, gum, and starch, (substances quite unlike in their appearance and uses,) are yet formed from the

same elements, and in nearly or precisely the same proportions by a chemistry which we have not yet fathomed. Whether this supposition be correct or not, there is little doubt that if we understood fully all the influences at work, and could estimate fairly all the data to judge from, we might predict with confidence what would be the characteristics of the progeny from any given union. It may not be out of place here to say that much of the talk about *blood* in animals, especially horses, is sheer nonsense. When a "blood horse" is spoken of, it means, so far as it means anything, that his pedigree can be traced to Arabian or Barbary origin, and so is possessed of the peculiar type of structure and great nervous energy which usually attaches to thorough-bred horses. When a bull, or cow, or sheep, is said to be of "pure blood," it means simply that the animal is of some distinct variety; that it has been bred from an ancestry all of which were marked by the same peculiarities and characteristics. So long as the term "blood" is used to convey the idea of *definite hereditary qualities,* it may not be objectionable. We frequently use expressions which are not strictly accurate, as when we speak of the sun's rising and setting, and, so long as everybody knows that we refer to apparent position, and not to any motion of the sun, no false ideas are conveyed. But to suppose that the hereditary qualities of an animal attach to the blood more than to any other fluid, or to any of the tissues of the body, or that the blood of a high-bred horse is essentially different from that of another, is erroneous. The qualities of an animal depend upon its organization and endowments, and the blood is only the vehicle by which these are nourished and sustained. Moreover, the blood varies in quality, composition, and amount, according to the food eaten, the air breathed, and the exercise taken. If one horse is better than another, it is not because the fluid in his veins is of superior quality, but rather because his structure is more perfect mechanically, and because nervous energy is present in fitting amount and intensity.

For illustration, take two horses, one so built and endowed that he can draw two tons or more three miles in an hour; the other so that he can trot a mile in three minutes or less. Let us suppose the blood coursing in the veins of each to be transferred to the other; would the draught horse acquire speed thereby, or the trotter acquire power? Just as much, and no more, as if you fed each for a month with the hay, oats, and water intended for the other. It is well to attend to pedigree, for thus only can we know what are the hereditary qualities; but it is not well to lay too much stress upon "blood." What matters it that my horse was sired by such a one or such a one, if he be himself defective. In breeding horses *structure* is first, and endowment with nervous energy is next to be seen to, and then pedigree; afterwards that these be fittingly united, by proper selection for coupling, in order to secure the highest degree of probability which the nature of the case admits, that the offspring may prove a perfect machine, and be suitably endowed with motive power. "The body of an animal is a piece of mechanism the moving power of which is the vital principle which, like fire to the steam-engine, sets the whole in motion; but, whatever quantity of fire or vital energy may be applied, neither the animal, machine, nor the engine, will work with regularity and effect unless the individual parts of which the machine is composed are properly adjusted and fitted for the purposes for which they are intended; or, if it is found that the machine does move by the increase of moving power, still the motion is irregular and imperfect; the bolts and joints are continually giving way; there is a continued straining of the various parts, and the machine becomes worn out and useless in half the time it might have lasted if the proportions had been just and accurate. Such is the case with the animal machine. It is not enough that it is put in motion by the noblest spirit, or that it is nourished by the highest blood; every bone must have its just proportion; every muscle or tendon its proper pulley; every lever its proper length and fulcrum; every

joint its most accurate adjustment and proper lubrication; all must have their relative proportions and strength before the motions of the machine can be accurate, vigorous, and durable. In every machine modifications are required according as the purposes vary to which it is applied. The heavy dray-horse is far from having the arrangement necessary for the purposes of the turf, while the thoroughbred is as ill-adapted for the dray. Animals are therefore to be selected for the individual purposes for which they are intended, with the modifications of form proper for the different uses to which they are to be applied; but, for whatever purpose they may be intended, there are some points which are common to all in the adjustment of the individual parts. If the bones want their due proportions, or are imperfectly placed; if the muscles or tendons want their proper levers; if the flexions of the joints be interrupted by the defectiveness of their mechanism, the animal must either be defective in motion or strength; the bones have irregular pressure, and, if they do not break, become diseased; if the muscles or tendons do not become sprained or ruptured, they are defective in their action; if friction or inflammation does not take place in the joints, the motions are awkward and grotesque. As in every other machine, the beauty of the animate, whether in motion or at rest, depends upon the arrangement of the individual parts."

Such knowledge as has been gained by observation and experience, regarding the relative influence of the parents, teaches emphatically that every stock-grower should, in the first place, use his utmost endeavor to obtain the services of the best sires; that is, *the best for the end and purposes in view;* that he depend chiefly on the sire for outward form and symmetry; and next, that he select dams best calculated to develop the good qualities of the male, depending chiefly upon these for freedom from internal disease, for hardihood, constitution, and generally for all qualities dependent upon the vital or nutritive system. The neglect which is too common, and especially in breeding horses, to the qualities of the dam, miserably old and inferior females being often employed, cannot be too strongly censured. In rearing valuable horses the dams are not of less consequence than the sires, although their influence upon the progeny be not the same. This is well understood and practiced upon by the Arab, who cultivates endurance and bottom. If his mare be of the true Kocklani breed he will part with her for no consideration whatever, while you can buy his stallion at a comparatively moderate price. The prevalent practice in England and America of cultivating speed in preference to other qualities has led us to attach greater importance to the male, and the too common neglect of health, vigor, endurance, and constitution in the mares has, in thousands of cases, entailed the loss of qualities not less valuable, and without which speed alone is of comparatively little worth.

Our allotted space is filled, perhaps overrun. So far from having exhausted the Physiology of Breeding, we have merely passed its threshold, treating, briefly enough, several of its interesting points. Some others, of great importance, both theoretically and practically, such as the influence of maturity, the law of sex, "in and in" breeding, crossing, etc., are necessarily excluded.

In conclusion, let us earnestly invite those who cultivate domestic animals to observe critically all interesting and instructive facts bearing on our subject, and to record them faithfully, as well for public benefit as for private reference. It is by increase of knowledge that progress must be made, if at all; by generalizations and deductions carefully drawn from numerous and well-authenticated facts. Breeding, as an art, in this country is in its infancy. A glimpse of the stature it may attain unto is afforded us by the success attending the exhibition of the horses of Mr. Ten Broeck and the cattle of Mr. Thorne upon Britain's own soil and in competition with the best of her own growth. We have the best material to begin with or to go on with which ever existed on

the earth. We have a country for its development, which in soil, in climate, in food, in freedom from diseases, and in other facilities, has no superior, and probably no equal in the world.

Let scientific knowledge and practical skill take the place of prevalent ignorance and carelessness, and improvement must go rapidly forward, and accomplish almost incalculable results.

CONDITION AND PROSPECTS OF SHEEP HUSBANDRY IN THE UNITED STATES.

In all ages has the sheep been a prominent representative of rural husbandry. From the time of the patriarchs it has parted with its coat to furnish man a covering, yielded its flesh to renew his muscular tissues, and even given him a standard of value and a medium of exchange. Eccentric John Randolph, as a narrow politician, hating bitterly a manufacturing policy, could indeed declare he would at any time go a mile out of his way "to kick a sheep;" but intelligent farmers, from the time when old Fitzherbert asserted that "sheep is the most profitablest cattle that a man can have," down to the present hour, are unanimous in giving sheep husbandry a front rank in the industries of agriculture.

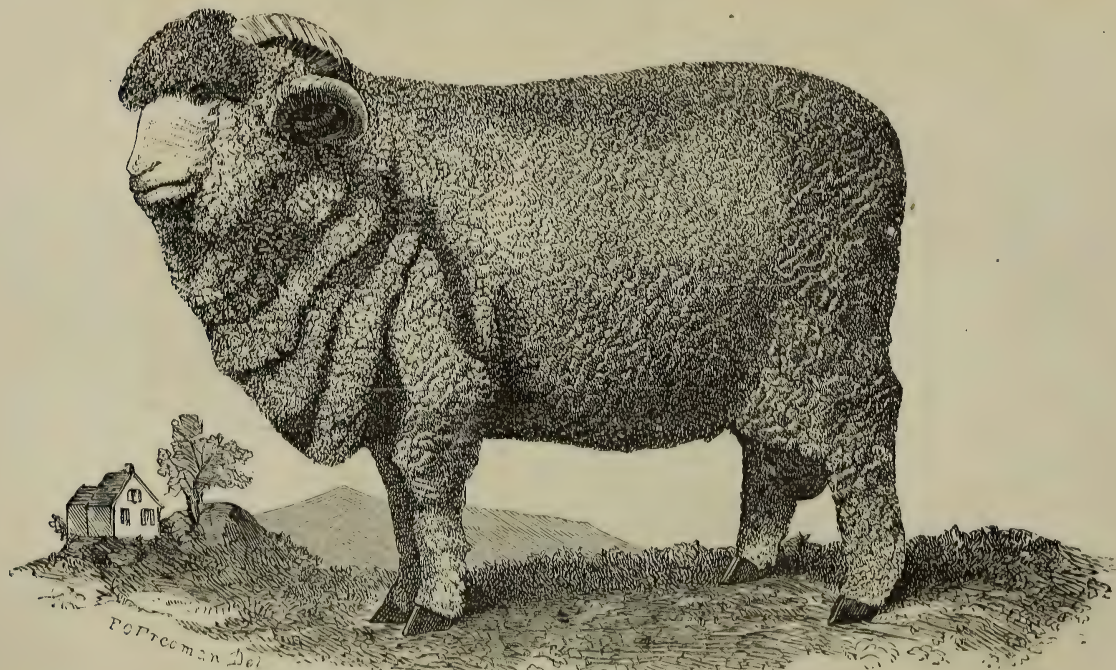
In early days, while a command to man to "increase and multiply" was religiously obeyed, it became the destiny of the sheep mainly to feed and clothe his offspring.

Youth found familiar companionship with the pet lambs of the flock; beauty, with the low voice and gentle manner of woman, led them to the green oasis and the deep well; the manly shepherd watched over them, and carried the weary to places of safety; and all found in them food, clothing, wealth, and emblems of gentleness and innocence.

And it is noteworthy as it is true, that the animal best suited to the primal condition of man in his nomadic state should be the one most profitable and most necessary to the highest condition of improved farm culture. As an investment the sheep yields a quick return, and gives it in many ways, viz: a large percentage of its value yearly in wool; lambs, in many cases doublets, sometimes twice, yearly; manure, of superior quality, little liable to fermentation and loss from ordinary exposure; when dead, flesh, nutritious and healthful, produced at less cost than pork and beef; and pelts, always salable and valuable.

Here are "quick returns and *large* profits." And the profits are all the larger, because less care, less shelter, less succulent and nutritious herbage, are required, than for any other animal.

The successful amateur English farmer, Mechi, says that beef must sell twenty per cent. higher than mutton to make them of equal profit. And in many sections of this country, according to intelligent observers, mutton can be produced at little more than half the cost of pork; while it is equally valuable as food, and more healthful. While sheep are found to represent largely the wealth of primitive agriculture, they only receive their highest development and attain their largest measure of utility and profit under the most



"SWEEPSTAKES"

Pure-bred Spanish Merino Ram, bred by E. Hammond, Middlebury, Vermont.

Weight of carcass, 138 lbs. Weight of heaviest fleece, 27 lbs.

From Photograph for Randall's "Practical Shepherd."

intelligent husbandry, in communities sustaining the highest forms of civilization.

As an article of food mutton may almost be said to be an index of civilization, the popular taste by degrees tending from grosser food, as rudeness in primitive society gradually gives way to refinement.

The editor of the Southern Cultivator once said, in rebuke of the vulgar taste that preferred the increase of packs of worthless dogs to the safety and improvement of sheep: "Civilization has to be further advanced than it would be proper to name before a community will think as much of sheep as it does of dogs." The history of this branch of stock-growing in this country sustains such theory.

VARIETIES OF SHEEP.

"NATIVES."

The sheep of this country known as "native" stock are mainly of English origin, mingled to some extent with continental blood, and are called "natives," simply to distinguish them from Merinos and more recently imported and improved breeds.

Those originally introduced into New York were from Holland. The English were long-legged, narrow-breasted, light-quartered, coarse-woolled animals, hardy, roving in habit, wild as the mountain sheep, but excellent breeders and good mothers.

Twelve pounds per quarter was a fair average for them. There were some exceptional flocks, exhibiting pretty strong indications of excellences since brought out in improved breeds. They cannot be claimed as a distinct breed, being doubtless almost as various as our flocks of the present day, each emigrant carrying with him his favorite sheep. Mr. Youatt speaks of a portion of them as a "coarse kind of Leicester." Mr. Livingston, in his "Essay on Sheep," saw in some of them a strong resemblance to the South Downs.

It was natural that colonists, peopling a wilderness in a climate of greater rigor than that from which they came, with a wise reference to clothing as well as food, should give particular attention to the introduction of sheep; hence it is written, as early as 1676, that "New England abounds in sheep."

In 1790, in New Netherlands, (New York,) they were kept somewhat extensively, throve well, became fat, and multiplied; but the depredations of wolves, and the loss of wool by brush and tangled thickets, were serious drawbacks upon sheep-raising.

The yield of wool at this date was two to three and a half pounds in the hands of good farmers; the general average was doubtless less. In the hands of good farmers now, improved flocks yield an average of four, five, and six pounds, and very much more in some cases; yet the census returns for 1860 make an average of less than three pounds, which is an improvement upon 1850, as that census showed a similar advance from 1840.

James S. Grinnell, in the report of the Massachusetts State Board of Agriculture for 1860, says the "native sheep" of that State "were of two kinds: one with white faces, and the other with dark faces and legs; the first seem to have been preserved in the eastern part of the State and on the islands, while the latter have been known in the valley of the Connecticut by the name of "English smuts," or "Irish smuts." These last may have been South Downs, imported before the improvement of that celebrated breed, as they bear many of their characteristics, and might, had they been bred with the care and perseverance which the South Downs received, have been a most valuable breed.

The wool of these sheep was suited only to the manufacture of coarse fabrics, and supplied the material for the home manufactures, in which almost

every family participated, furnishing all woollens used, except fine cloths imported from the mother country.

The mutton was mostly of coarse quality, and by no means a favorite article of diet. Some of it, however, was fat enough; "so exceeding fat that it was too luscious and offensive;" according to Vanderdonk's description of some of the Dutch sheep in "New Netherlands." Its unpopularity was doubtless owing partly to inferior quality and partly to a taste uncultivated in mutton fancying. The stock of a hundred years since is nearly extinct, or so modified by crossing, first with the Spanish Merino, to some slight degree with French and Saxon, and subsequently with the South Down, the Leicester, and other breeds, as to partake little of its original characteristics.

The sheep-farmer will not regret their utter extinction, if displaced by breeds superior in wool, flesh, and aptitude to fatten.

SPANISH MERINOS.

The fine-woolled sheep of Spain have been famous for centuries. Those of Castile and Leon, the "Transhumantes," or travelling flocks, bear the largest and finest fleeces. Those of Soria have very fine wool upon an inferior carcase, while those of Valencia have a fine wool of short staple; in both of these districts the flocks are stationary. Jorvellanes, a Spanish writer, estimating the migratory sheep at five millions, has deplored the injury to husbandry by the monopoly (under royal protection) of all the best pastures in the kingdom, the enjoyment of special privileges in travelling to and from these summer mountain pastures, and the consequent banishment of stationary flocks and the depopulation of the country; and all for the advantage of a few aristocratic proprietors. This superior breed of travelled sheep is divided into several families; the Escurial, with wool of excelling fineness; the Guadaloupe, noted for symmetry of form, fine quality and good quantity of wool, with an awkward enlargement of the throat and a hairy appearance in the lambs; the Negretti, the largest and strongest of the migratory sheep; the Infantados, Aqueirres, Paulars, Montarcos, and others.

The Merinos vary greatly, not only in Spain, as might be expected with so many different families, but in the different countries into which they have been introduced. Still they retain, in a remarkable degree, the prominent peculiarities of the breed—fineness of wool, comparatively small size, short legs, a fine eye, a bold step, hardiness, and longevity. Compared with recent improvements in mutton-breeds, the legs, it is true, might seem long, but they are shorter than the unimproved sheep.

The first Spanish sheep brought to this country were two ewes and a ram, smuggled on shipboard (for their exportation was at that time prohibited) by Wm. Foster, a young gentleman of Boston, travelling in Europe. They arrived safely and were presented to Andrew Craigie, of Cambridge, Massachusetts, who, tiring of their care and ignorant of their value, ate them, and subsequently paid $1,000 for a Merino ram. In 1801, Dupont de Nemours, with a Parisian banker named Delissert, shipped four ram lambs to this country, but one of which, "Don Pedro," a fine animal, weighing 138 pounds and bearing a fleece of 8 pounds 8 ounces when thoroughly washed, lived to arrive, and was used in New York until 1808, and then became the property of E. I. Dupont, living near Wilmington, Delaware, where he founded a valuable flock for his owner.

In 1801, also, Seth Adams, of Zanesville, Ohio, is said to have imported a pair. In 1802, Chancellor Livingston, American minister at France, sent to his farm in New York two pairs of Merinos, from the French national flock at Chalons. Colonel David Humphreys, of Connecticut, American minister at Spain, brought home, in the same year, a flock of Spanish sheep. Mr. Muller imported a pair in 1807, which were kept near Philadelphia.

In 1809 and 1810, Wm. Jarvis, consul at Lisbon, shipped three thousand

eight hundred and fifty to the United States, to be distributed, fifteen hundred in New York; one thousand in Boston and Newburyport; the remainder to Philadelphia, Baltimore, Alexandria, Norfolk, and Richmond, reserving three hundred and fifty for himself, half Paulars, one-fourth Aqueirres, the other fourth Escurials, Negrettis, and Montarcos, which latter were bred together.

These flocks were obtainable in consequence of the French invasion of Spain and royal destitution of money or resources, occasioning the sale of the confiscated flocks and other property of four grandees, viz: the Prince of Peace, owning the Paulars; the Conde Campo de Alange, proprietor of the Negrettis; the Conde de Aqueirres, and the Conde de Montarco. There were fifty thousand; five thousand of each of the former two, and twenty thousand of each of the latter two. About twenty thousand five hundred were sold, the remainder consumed in the supply department of the Spanish army.

In addition to those sent by Mr. Jarvis, other individuals, in 1810, sent two thousand and five hundred, all of Leonese blood, of the first flocks of Spain. Subsequently frequent importations were made.

FRENCH MERINOS.

The *French Merinos,* a family established from the Spanish, under imperial protection and with peculiar management, were larger than their progenitors, with good but not the best wool, a loose skin disposed in pendulous folds, and a very heavy fleece, very yolky, with little external gum. In 1796 the average weight of fleece was 6 lbs. 9 oz.; in 1797, 8 lbs.; 1798, 7 lbs.; 1799, 8 lbs.; 1800, 8 lbs.; 1801, 9 lbs. 1 oz. In later years rams have sheared from 18 to 24 lbs. These fleeces would shrink one-half in washing. Mr. Livingston made the shrinkage sixty per cent. High feeding, and a general forcing process in their subsequent development, while it gave larger animals and more wool, resulted in diminished hardiness, poorer quality of wool, and unevenness of fleece. French Merinos are now unpopular and are very generally discarded, so that traces of their blood yet remaining in the country are rapidly disappearing.

SAXON MERINOS.

The sheep of Saxony, originally introduced by the Elector of Saxony from Spain, are regarded as a distinct breed, yet are properly a branch of the Merino family. They are remarkable for the exceeding fineness of their wool; but their fleeces are so light and thin, and their constitution so fragile from extreme tenderness of treatment, that they are not generally regarded as a reliable or profitable breed for the rough sheep husbandry and rougher climate of this country. Their fleeces average little more than two pounds.

They were first introduced into this country by Samuel Henshaw, of Boston, in 1823. In 1824 the Messrs. Searle, of Boston, imported seventy-seven; and in the same year, in connexion with Mr. Henry D. Grove, nearly two hundred more. In the following years, up to 1828, numerous importations were made, when their popularity began to decline.

SILESIAN MERINOS.

This offshoot from the Spanish stock, originating some fifty years ago from a flock of Infantado ewes and Negretti bucks imported into Silesia, has become a breed of considerable note, bearing wool of an exquisite fineness. Mr. Randall, in his recent admirable treatise on fine wool sheep husbandry, deems them peculiarly fitted to the office of improving coarse families of Merinos in evenness and fineness of fleece. They are as large as the American Merinos, the fleece yolky and dark colored, but destitute of gum. They are claimed to be hardy, having been bred with skill and care, but not pampered in feeding.

AMERICAN MERINOS.

The *American Merinos* should be referred to as a self-sustaining and distinct variety of the original race, though adhering more closely to its peculiar characteristics than its kindred sketched in the preceding paragraphs. The American Merinos are classified in three prominent families—the Jarvis, the American Infantado, (Atwood,) and the Paular sheep.

The Jarvis are the result of the mixture of the several Leonese varieties. Without following the indiscriminate course of French breeders, which has resulted in utterly destroying all uniformity or fixity of character in any important point, Mr. Jarvis was induced, according to the authority of his son, in opposition to his better judgment, to heed the importunity of the manufacturers for a quality of wool resembling the Saxon, and to select bucks from whatever source seemed likely to effect his purpose. Yet this breeding was judiciously done, in accordance with an established standard rigidly adhered to. They are characterized as having a loose, thick skin, with few corrugations; little external gum, and thence comparatively light color; a fine, even fleece, with a brilliancy and style almost equalling the Saxon, and a strong likeness to the Spanish Escurial, but with a heavier fleece, and for this country, in the estimation of Mr. Randall, "a more valuable sheep than those of the Royal Cabana of Spain."

The American Infantados were bred from Humphrey's importation by Stephen Atwood, of Connecticut. They are of large size, short-necked, short-hipped, broad-shouldered, round, and symmetrical. Their skins are loose and mellow, and of a deep rose color; the wool short, very yolky, with a black external gum. The wool is scarcely surpassed for quality, style, and evenness. Dr. Spencer, of De Ruyter, New York, who has a fine flock of this family, averaged, in 1861, a fraction over seven pounds of wool from each sheep, the ewes weighing about ninety-five pounds, and averaging within a fraction of twenty-four inches in height. Edwin Hammond, of Middlebury, Vermont, whose skill and patient effort have wrought much of the improvement in the "Atwood" sheep, says that he sheared two hundred sheep in 1861, and obtained an average of within an ounce or two of ten pounds. His best rams yielded about twenty-five pounds each.

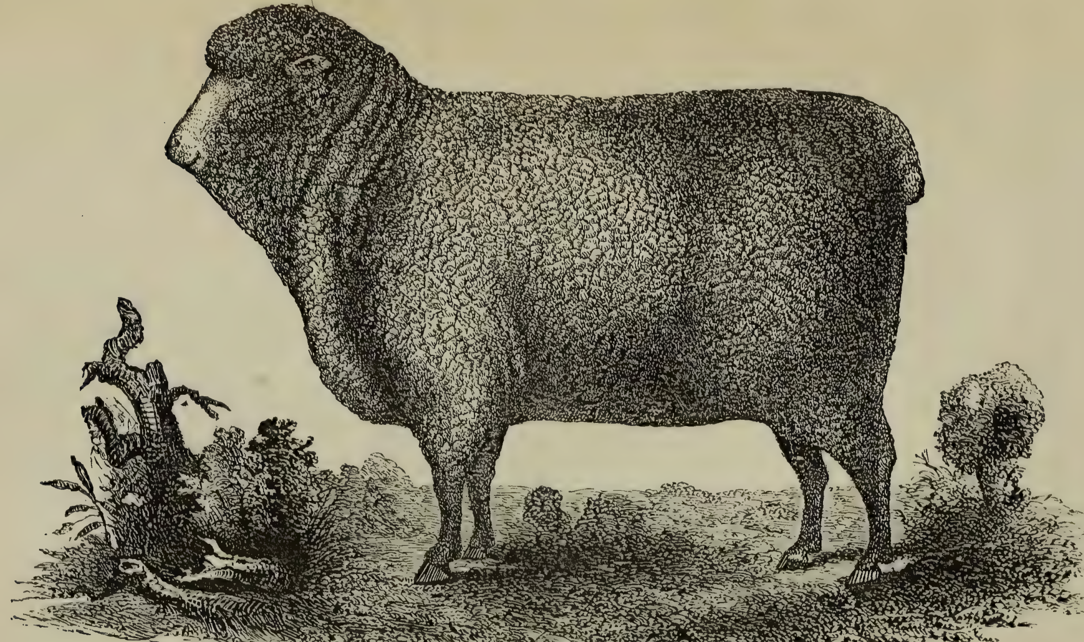
The Paulars are a heavy, thick-fleeced, very hardy variety, which has been much improved in later years, with less of fineness and evenness of fleece than the Atwoods or Infantados, and less of yolk and external gum, yet much more than the Jarvis or mixed Leonese. Randall says:

"Twenty years ago they were heavy, low, broad sheep, full in the bosom and buttock, with strong bones, thick, short necks, and thick, coarse heads. The ewes had deep, pendulous, and sometimes plaited dewlaps, and folds of moderate size about the neck; the rams had both in a greater degree."

LEICESTERS.

Abruptly turning from short, fine wools, to the long, coarse staples, the improved Leicesters challenge the first consideration. They are thus described by Youatt:

"The head should be hornless, long, small, tapering towards the muzzle, and projecting horizontally forward. The eyes prominent, but with a quiet expression. The ears thin, rather long, and directed backward. The neck full and broad at its base, where it proceeds from the chest, so that there is, with the slightest possible elevation, one continued horizontal line from the rump to the poll. The breast broad and round, and no uneven or angular formation where the shoulders join either neck or the back; particularly no rising of the withers or hollow behind the situation of these bones. The arm fleshy through its whole extent, and even down to the knee. The bones of the leg small, standing wide apart; no looseness of skin about them, and comparatively bare of wool. The chest and barrel at once deep and round, the ribs forming a considerable arch from the spine, so as in some cases, and especially when the animal is in good condition, to make the apparent width of the chest even greater than the depth. The barrel ribbed well home; no irregularity of line on the



F. O. Freeman Del.

Pure-bred Merino Ewe of the "Paular" Stock, bred by Hon. H. S. Randall, Cortland Village, New York.

Age, three years. *Weight of fleece, 10 lbs.*

From Photograph for Randall's "Practical Shepherd."

back or belly, but on the sides; the carcase very gradually diminishing in width toward the rump. The quarters long and full, and, as with the forelegs, the muscles extending down to the hock: the thighs also wide and full. The legs of a moderate length; the pelt also moderately thin, but soft and elastic, and covered with a good quantity of white wool."

This variety, constituting the staple breed of the midland counties of England, and claimed by Wilson to be "more widely diffused through the kingdom than any of their congeners," was formed, by persevering efforts in breeding for a special purpose of Robert Bakewell, of Dishley, in the county of Leicester. Hence it has borne the names of Leicester, Dishley, and Bakewell, respectively. He wished to establish a breed having a greater aptitude to fatten, and a consequent earlier maturity, without the prominent defects of existing breeds. Commencing, in 1755, with the old Leicesters, he sought as bucks individuals possessing the desired qualities without regard to families or relationship, and then pursued a course of in-and-in breeding, when it seemed to favor his grand object, until he succeeded in establishing a breed that was mature at two years instead of four, taking on fat very readily, extremely docile, with little offal, small in head and bone, weighing from eighteen to twenty pounds per quarter at fourteen months. This is understood to have been his general course, but the particulars of his system, so successful that no progress has been made since his days, is enveloped in secrecy. It is asserted, however, by some, that he did not hesitate to use fine specimens of the Lincolns and other breeds in the perfection of this variety.

It was a serious undertaking to change the large, heavy, slow-feeding, and coarse-grained Leicester into the improved variety of the present day. The Herefordshire, Heath, Cheviot, Black-faced, and other breeds, arrived at maturity at four years; the Leicester was scarcely earlier in its maturity, disproportionate, like these varieties, in offal, bone, and inferior qualities of flesh. He seemed to care little for wool or for size, and, observing a greater tendency to take on fat and muscle in sheep of medium size, it is supposed that he adhered to this as one of his principles of selection. By such means a permanency was given to the desired characteristics of his flock, yet at the expense of the constitution, the hardiness, the fecundity, and the reputation as nurses of the original, in all of which respects they are inferior.

It was a successful effort on the part of Bakewell to form a sheep, suited to low lands and rich pasturage, that would produce the greatest amount of salable mutton from the least food in the shortest space of time—in other words, an ovine machine for converting turnips into coin with greatest rapidity.

The defects already indicated are very serious objections to the Leicesters in this country; so much so, that pure bred specimens are scarcely to be found here, those bearing the name having a portion of Cotswold, Cheviot, or other blood. English farmers are pursuing a similar course of improvement. Leicester rams are now in great demand there, for crossing with other breeds. In the bluegrass region of Kentucky and southern Ohio, where the Durham cattle flourish, they are regarded by many sheep-breeders with considerable favor.

Their mutton is too fat for American tastes; crossed with natives, though coarse-grained, it becomes very acceptable. The fat is laid very heavily upon the outside, and accumulates so rapidly that even in England, where fat mutton is popular, it is less palatable and valuable in the market after the animal has passed the age of fourteen months. It is acceptable to poor work people there, for use in soups, the excess of fat converting the largest quantity of vegetables into nutritious and palatable food. Its market value, however, is less by two to two and a half cents per pound than South Down mutton. The different qualities of mutton sold in Leadenhall and Newgate markets in 1861 ranged in price from nine and a half to fifteen and a half cents per pound.

COTSWOLDS.

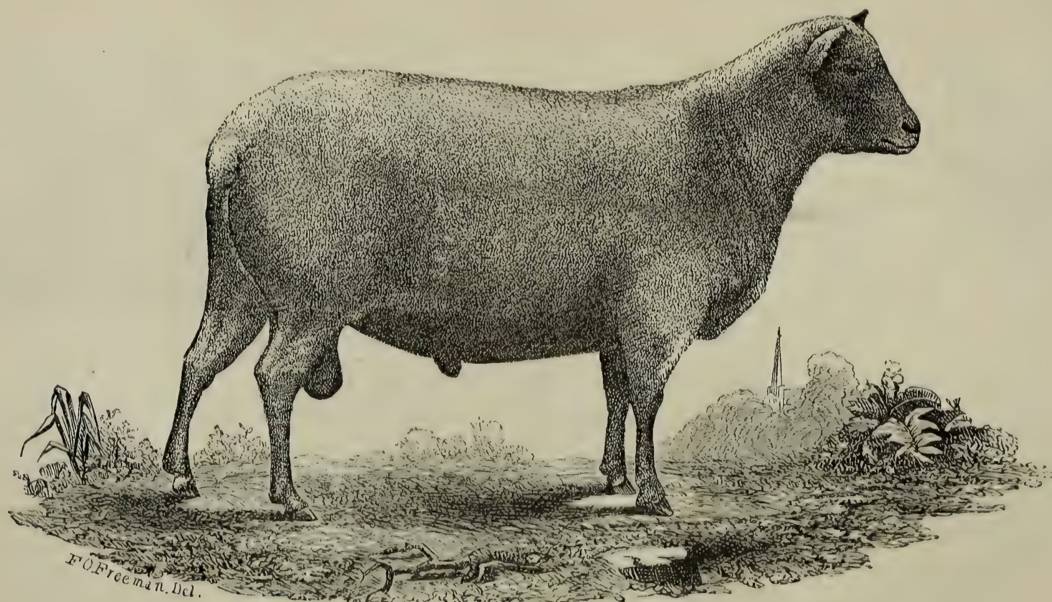
The Cotswolds, of the county of Gloucester, England, are of great antiquity, but have been greatly modified and improved within twenty years. They are sometimes called Gloucesters, sometimes New Oxfordshires. There has been a variety known by the latter name, made by crossing Leicester bucks upon Cotswold ewes; but the distinction between them and Cotswolds is not now recognized in England, the original stock being nearly extinct, and the new breed being known as improved Cotswolds. They are greatly superior to the Leicester in weight of wool, size, hardiness, vitality; are much more prolific, many of them habitually bearing twins, and excellent as nurses. Their fleeces are somewhat heavier than the Leicester, usually averaging seven or eight pounds. They are possessed of a good figure and have a portly gait. The rams sometimes attain the weight of 300 pounds, and one is known to have weighed 374 pounds. The wool is of moderate fineness, long, white, and strong. They have a long, thin head, well set on, broad chest, well rounded barrel, and straight back. For rapidity of growth they vie with the Leicester, can scarcely be excelled for docility, and are unsurpassed in size and weight. Their mutton is coarse-grained and very fat, but better intermixed than the Leicester, which has three or four and sometimes five or six inches of fat upon the outside, as fed in England. They are now extensively used for crossing with other sheep, to obtain early lambs for market, both in this and in the mother country, and are rising rapidly in public estimation. For rich pastures, in regions where grain is abundant and cheap, they are invaluable, and especially to be preferred in view of the roughness and negligence characterizing the American system, or rather want of system, of sheep husbandry, to the pampered and delicate Leicesters. They have been in the country for thirty years or more, and are now largely imported from Canada.

SOUTH DOWNS.

This breed, if not quite so old as the chalky hills that afford the scant herbage upon which it thrives, dates back to the middle ages. To be sure, the original breed had little of the beauty and admirable points of the improved, though it possessed the germ of those qualities. The improvement of this breed has been progressing, slowly and continuously, since its commencement, by John Ellman, of Glynde, Sussex county, some eighty-five years ago. He pursued a course of pure breeding, with judgment, patience, zeal, and an intelligent liberality. He sought a form symmetrical and profitable; a flesh-and-fat producing habit, without inflicting injury upon constitution, health, fecundity, or matronly qualities; and he was eminently successful, through care and perseverance, exercised without deception, humbug, or egotism.

The originals, with light forequarters, narrow chests, long necks and limbs, were totally changed in these particulars. The South Down now has a small head without horns, a long gray or brown face of medium length, thin lips and under jaw, woolly ears and forehead, and a full and bright eye; a neck thin near the head, and widening into graceful symmetry as it joins the shoulders; a deep, wide breast, projecting forward; the shoulders not too wide above, bowing outward from the top to the breast; the back flat from shoulder to tail; the ribs extending horizontally and backward, and then curving downward barrelwise; the loin and rump broad; the hips wide; the tail set high; the belly straight, like the back; the legs of medium length; the forelegs straight, standing far apart; the hock turning slightly outwards; the twist very full; the bones fine; the wool short, curled, and fine, and destitute of fibrous spires that give the felting properties of wools.

As prolific breeders, the Down families are unsurpassed, and scarcely equalled



Imported Southdown Ram. (*Sheared.*)

(FROM PHOTOGRAPH.)

by any other breeds. Their English reputation in this respect is fully reasserted in this country. Notable instances, as evidence, could be given of every flock of this breed in the United States—among them, that of J. C. Taylor, of Holmdell, New Jersey, has repeatedly and uniformly given evidences of remarkable fecundity. Mr. Taylor has estimated the proportion of ewes bringing twins in the South Down flocks of the country at fifty per cent.

The sheep walks of Sussex, Hampshire, Shropshire, and other localities characterized by sandy hills of the chalk formation, interspersed with patches of arable soil, sometimes test the admirable stocking qualities of these sheep, and prove their endurance of short keep. This quality enables them to endure well the neglect of American farmers and thrive vigorously upon our hills and uplands, where a pampered Leicester would die. Their hardiness enables them to live through our severe storms and harsh winds, on the leeward side of a haystack, and amid a western farmer's wilderness of wheat straw, out on the unprotected prairie. Of the mutton it is needless to write. It is everywhere regarded as an already attained ideal of perfection in that wholesome and nutritious meat. The flavor is delicate, the flesh juicy, the fat well intermixed, and its excess laid on internally. It bears the highest price, the best quality bringing fifteen to sixteen cents, while inferior mutton is worth but nine and ten, and the best of other breeds only reach twelve and thirteen cents as the topmost price. They are regarded as the best breed for use "as a working flock," so prolific, so healthy in large flocks, so useful in folding for manure, and so easily fed upon elevated situations and the natural pastures of dry uplands. Above all, they are invaluable for crossing for early lambs, particularly upon the Cotswolds.

The South Downs are chiefly bred in England, in the counties of Sussex, Surry, Hants, Wilts, and Dorset. In this country they are introduced, to a considerable extent, throughout the most eastern and middle States, the most densely peopled sections of the west, and especially in the neighborhood of cities.

HAMPSHIRE DOWNS.

This variety of the Down family is really a cross breed, formed from the white-faced, horned Hampshire and Wiltshire sheep, coupled with South Down rams, which were selected of the darkest faces, till the white faces were changed to dark, and their horns literally bred off. In the meantime their want of compactness was remedied, the back broadened, the barrel rounded, the legs shortened, and the entire appearance of the animal wonderfully changed. The original hardiness of the native breed was retained with their disposition to make early growth.

Thus was constituted, on the established principles of cross-breeding, a breed slightly coarser, heavier, with longer wool but less symmetrical shape. The lambs are usually dropped early and fed for the markets, or kept until the following spring, when they usually weigh eighty to one hundred pounds, and command a good market. Like the South Downs, they are extensively used for crossing with other breeds. They are especially valuable for the northern portions of this country, on account of their peculiar hardiness. They are regarded as very a valuable breed, compensating fully for the want of the delicate head, small legs, and general symmetry of the Sussex or South Down, by their greater weight of carcase and wool, and somewhat earlier maturity.

SHROPSHIRE DOWNS.

These sheep are the result of several crosses, the foundation being the "short-legged" and square-framed "Clun-Forest," with brown face and legs, and the Ryland, a white-faced, finer woolled sheep, approaching the Merino in quality of wool and general appearance. The Hampshire and South Down

blood was then brought into requisition, refining and elevating the common stock into the large and symmetrical Shropshire of the present day, a finely-formed sheep, with the head of the original "Forest," and South Down deep chests, broad hips, and straight back, a tail set high, and a thick fleece of medium wool, weighing from five to seven pounds. They are remarkably free from liability to disease, and are favorably regarded for their fecundity, early maturity, weight of carcase and wool, and facility of fattening upon comparatively small quantity of food. The fleece, also, like the Lincoln and Romney Marsh, when they are well fed, is of that glossy staple so much sought at the present time for a certain class of lustrous goods.

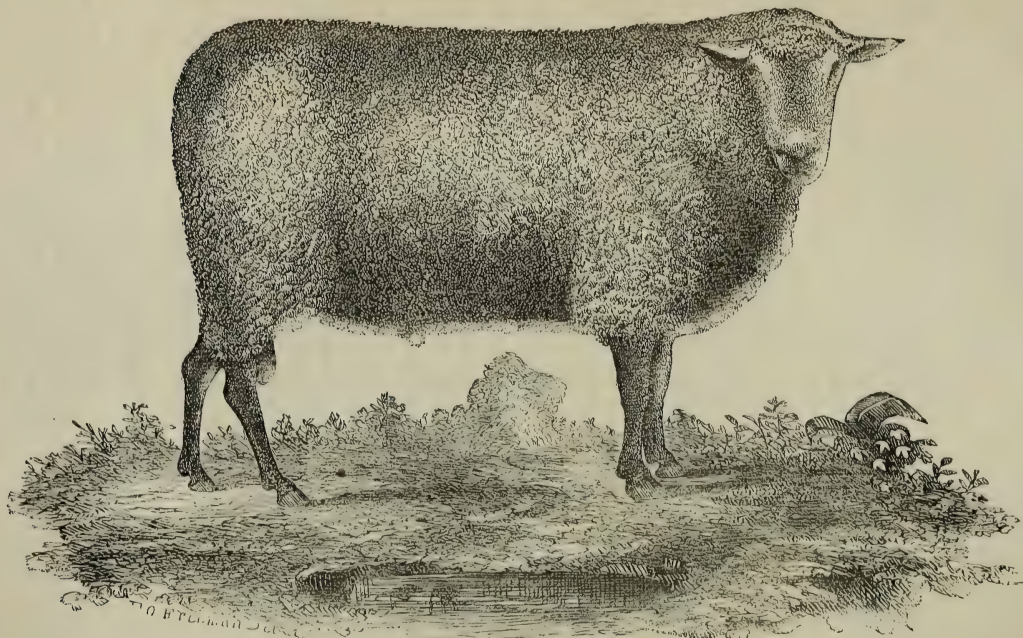
OXFORD DOWNS.

This is the last of the Down cross-breeds to be noticed here, but by no means one of the least importance. They are, perhaps, in better repute in this country than either of the others. They were produced by coupling Cotswold rams with Hampshire ewes, occasionally using the South Down to perfect the cross. By such a course of breeding, skillfully and carefully continued, an animal of uniform character has been produced, characterized by hardiness of constitution, good size, heavy fleece, facility of fattening, and excellent mutton. They have been imported by Richard S. Fay, esq., of Lynn, Massachusetts; by Hon. William C. Rives, of Virginia; by Hon. David Sears, jr., of Boston, Massachusetts, and others. James S. Grinnell, esq., of Greenfield, Massachusetts, who had a fine flock of this breed, (now owned by S. A. Smead, of that place,) says of them, in the Massachusetts "Report" for 1860:

"The Oxford Downs have gray faces and legs, not quite so dark as the South Downs; head fine, and well set; small bone, deep brisket, round hams; good, flat backs; hips wide, and tail set up high; belly straight; buttock square; legs rather short and fine, and twist full; the loin is very wide and deep, and a wide spread between the hind legs for the development of the udder. They are exceedingly gentle, quiet, and orderly, never jumping and not inclined to ramble; they are hearty feeders, and will thrive on anything given to them, and bear, better than any other large sheep, scanty pasturage. The ewes very commonly have twins, and suckle them both; the lambs thrive very fast, often reaching one hundred pounds in five months on nothing but milk and grass. A yearling ram from Mr. Fay's flock gained fifteen pounds in three weeks, and a ram lamb weighing eighty-five pounds at five months, at six months weighed one hundred and five pounds, on nothing but grass. A yearling ram, seventeen months old, imported this season by Mr. Fay, weighed, just off the ship, two hundred and fifty pounds, and at twenty-one months three hundred pounds, and a five year old ram of this breed weighed this spring three hundred and sixty pounds. Mr. Fay's ewes weigh from one hundred and fifty to one hundred and eighty pounds."

This breed yields a very desirable quality of thick and heavy wool, weighing about seven pounds to the fleece, according to the experience of breeders in this country. Mr. Spooner considers it the result of the most successful attempt at cross-breeding ever made in England. He adduces, from certain experiments in feeding of Oxford Downs with Cotswolds, Leicesters, Hampshire Downs, and South Downs, the apparent fact that these cross-bred varieties surpassed the others in quality and productive value of their mutton, compared with the fleece and flesh of short wools.

In the discussion upon cross-breeds of the London "Farmers' Club," Mr. Hitchman, a breeder of Oxford Downs for twenty-five years, regarded them as the best rent-paying breed, and believed that no sheep will produce more or better mutton. And Mr. Joseph Roberts, who has kept them twenty-seven years, adds: "I have no doubt Cotswold sheep can, in their locality, be brought to greater weight per sheep than any other breed save Lincolns; but I question whether they can be made to produce more money value, as a whole flock, than Oxfordshire Downs, allowing for the prolificacy of the latter; and I am of the opinion that the produce from the same number of ewes will exceed, in weight of flesh, any other breed."



Oxford Down Ram "HONEST ABE" *Owned by*
S. A. Smead, Greenfield, Mass.
Three years old. *Weight 260 lbs.*

(PHOTOGRAPHED BY ELY.)

VALUE OF CROSS BREEDS.

The effect of cross-breeding is acknowledged to be, in part, increase of size, fecundity, early maturity, and easy fattening. Hence they are sought by all engaged in raising early lambs for market—a business which is becoming one of the most popular and profitable branches of sheep husbandry, bringing quick returns, making the greatest possible weight for a given amount of feed, and securing the highest prices per pound, and a soft and valuable fleece.

There is now in England a universal prevalence of crosses, for the sake of early returns and good profits, the rams of pure breeds being used mainly to cross upon common and cross-bred varieties. The tendency is also strongly in that direction in this country.

In a report of the "Chester meeting," in a number of the British "Farmer's Magazine," it is said: "Cross-bred sheep are unusually prevailing, and why? because more wool and mutton are obtained than the pure breeds afford. The price of pure Down wool and mutton does not, to any extent, exceed that of cross-breeds. The art of breeding warrants this course; it is consequent from the improvement of both large and small breeds. Combined, they are the most profitable. We caution the breeders of pure bred animals against sheep of small size of any kind. They are getting behind the times in which we live. Even the mountain sheep are growing large."

The relative value of cross-bred sheep is shown conspicuously in the following table, the result of an experiment with some of the most productive and highly-esteemed of the established breeds of improved sheep. The Cotswolds, being the largest, were the basis of comparison, the number kept being proportioned to relative size:

	Comparative number kept.	Weight of fleece.	Value of fleece.	Weight of carcase at 14 months.	Value of mutton.	Total products.
		Lbs.	*Cents.*	*Lbs.*	*Cents.*	*Dollars.*
Cotswold	100	5 to 10	31 to 32	80	10½	1,241 66
Leicester	105	4 to 8	31 to 33½	68	10½	1,113 18
Hampshire Down	115	3 to 7	31 to 36	68	13½	1,020 62
South Down	120	2 to 6	33 to 37	60	14	1,317 70
Cross-bred	115	4 to 8	33 to 36	76	13½	1,464 50

A single experiment, conducted with great care and fairness, may be a guide to approximate accuracy of judgment, but should not be regarded as conclusive. This certainly makes a fair showing for the cross-breeds.

MUTTON *vs.* WOOL.

Of these several breeds of sheep, the most prominent and popular in Europe, embracing nearly all practically known in this country, which shall be recommended as preferred breeds? In sheep fancying, as in everything else, active-minded, practical men have strong preferences, not to say prejudices, and can never be expected to agree perfectly; nor is such agreement desirable, as it would prevent persistent effort in perfecting sheep, give to manufacturers wool unsuited to the diversity of fabrics, furnish mutton as little pleasing to the varied tastes of the people, narrow the limits of successful sheep husbandry, and dwarf the expanding intelligence and practical learning of the sheep-grower.

In the present condition of national affairs, when a demand for an immense increase in the production of wool is immediate and imperative, there is an irresistible tendency towards the growth of wool in preference to meat. It is a commendable ambition, an impulse both patriotic and profitable, to push the propagation of sheep solely for wool-producing; yet it may be, even now, that wool and mutton together, in our more populous districts, will yield a profit equalling that from the purely wool-bearing breeds. It is deemed proper, at least, to present considerations showing the increasing importance of the mutton varieties of sheep in this country, aside from the scarcity of wool.

INCREASE OF MUTTON EATING.

There are circumstances which must give a prevailing direction, from time to time, to every species of progress or culture in husbandry. In early days, while a lamb from the flock was always acceptable food, the sheep was mainly propagated for its wool, which furnished, with skins, the entire clothing of mankind. In thinly-settled districts in modern times, especially in places remote from such markets as may exist, the fine woolled or Merino families are more profitable, the expense of carriage being light, with wool, in comparison with the cost of driving the animals great distances to poor markets. Such breeds are, therefore, found prevailing in our Territories, in the extreme northwest, the sparsely-settled plains of Texas, among the pine-wood pastures of the Atlantic and Gulf coast belt of sandy soils, through the mountain ranges of Virginia, the Carolinas, Northern Georgia, Tennessee, and the hills of Southeastern Kentucky. In Vermont they prevailed, in former years, from inland position; at present from an additional advantage—the profit of furnishing the best blood of American Merinos to be found in the country (attained by a long and successful course of breeding) for the improvement of fine-woolled flocks in the several States and Territories. Fancy prices are yielding tempting returns, and it is not presumable, and perhaps not desirable, that such breeders as Edwin Hammond, John T. Rich, W. W. C. Wright, Henry Lane, and others, should be willing speedily to desist from their useful and profitable enterprises with this valuable breed; but the country is becoming more densely populated, and the taste for good mutton is growing upon the public. In ten years the increase of population has been thirty-five per cent.; in the same time the value of slaughtered animals had increased from $111,703,142 to $212,871,653—a gain of ninety per cent., a heavy proportion of the increase being in mutton. Hence a growing popularity of mutton breeds has naturally given them the preference in Massachusetts and southern portions of New England, with a strong tendency in that direction in the middle States and the more populous portions of the west. In fact, wherever railroads are numerous, the same result may be confidently expected.*

It is a curious fact, illustrative of the wonderful increase in mutton eating, that at the famous Brighton market, in the neighborhood of Boston, on the day before Christmas, in 1839, two men held the entire stock, consisting of only 400 sheep; and yet that monopoly at such a time could not raise the sluggish

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* In a recent number of "Moore's Rural New Yorker" is the following item, illustrative of the advance in the quality of mutton and the increase in the demand:

"With reference to the *mutton value* of this farm animal, we will only state that within our own recollection sheep were slaughtered by thousands in Western New York for the pelts and tallow. Less than twenty-five years ago 'Alleghany venison,' the title which it bore, was hawked about the streets of Rochester at nominal prices, and the seller would dispose of such of his load as remained on hand at nightfall to chandlers for manufacturing purposes. To-day butchers declare that it requires more time, and entails more labor, to procure a meagre supply of mutton for the shambles than to obtain all other meats. In the hope that this pressure would be relieved, they put up their offerings fifty cents per one hundred pounds two weeks since."

market more than a half cent per pound. In 1859, in the same market, on the day before Christmas, 5,400 sheep were sold.

Nor is this very strange. It was common, and is yet, in remote or Merino districts, for people to indicate an unconquerable aversion to mutton. It is, indeed, the poorest meat in the world; it is also the best. A poor, thin, lean sheep, of the native and Merino breeds—an animal that had outlived its many years of usefulness as a wool-bearer—was sometimes cut down by the relentless knife as a cumberer of the pasture ground, and consigned to the pot in the vain and hopeless effort of macerating its toughened fibres sufficiently to make its mastication a physical possibility. Alas! how many have suffered in such futile undertaking, and learned to loathe the very name of mutton, and to abominate its very smell.

On the contrary, not the aromatic flavors of venison, the gamy richness of wild fowl, or the sweet juiciness of a Durham sirloin, can surpass the combined virtues of South Down marrow-and-fatness. It is sweeter to the palate, digestible with greater facility, and more nutritious than almost any other variety of food. South Down grades, or breeds cross-bred with South Down, if not equal to it, are a wonderful improvement upon the slowly maturing kinds, and perhaps better suited than full-bloods to uneducated American palates, which cannot be expected to endure so sudden and great a change.

Henry S. Randall, the distinguished advocate of fine wools, and doubtless the best writer upon sheep husbandry in this country, in pleading for the recognition of Merino mutton, says: "Though the scarcity and value of full-blood Merinos have prevented many of them from appearing in our markets, the grades have always been favorites with the butcher and consumer." It is a graceful acknowledgment of the magical improvement caused by the infusion of the blood of mutton breeds. He sums up his argument in their favor, and adds: "I shall nowhere, however, be understood to advance the idea that it would be advisable, in the mutton districts proper, when access to a good market is quick and cheap, to substitute the Merino for the best English mutton varieties."

MUTTON PREFERRED TO BEEF IN ENGLAND.

"Roast beef" and an English dinner were formerly considered almost synonymous terms; but the statistics of English meat markets, and the statements of British authors, show conclusively that mutton, rather than beef, is the favorite food of the British nation.

The following statement will show the large and increasing consumption of mutton during the last six months of three consecutive years in the markets of that country:

	1858.	1859.	1860.
"Beasts"	147,118	143,198	145,420
Cows	3,137	3,030	3,015
Sheep and lambs	747,829	803,334	762,740
Calves	15,186	12,277	15,766
Pigs	19,441	16,130	15,470

Robert Herbert, in a survey of the market for 1860, reported that, with regard to the production and consumption of mutton, the former had not kept pace with the demand, which had continued remarkably healthy.

In 1860 the average price of prime beef was 16½ cents; of prime mutton, 18 cents; the best old Downs reached the figure of 19 cents.

During a period of fifteen years, including the last year, the average price of beef in England has been about 11¼ cents, while mutton has averaged 12¾ cents, the latter having made the greater advance during the period. Thus the greater consumption of mutton is not owing to its cheapness. In this country, too, the price of prime mutton has advanced rapidly. In the Albany market, for several years, mutton has sold from one to two cents higher than beef. In Boston and in New York good mutton also sells higher than beef. Inferior qualities sell low, in the west particularly. There is a constant upward tendency in price here, as in other countries, which a much more abundant supply will scarcely interfere with in many years to come. Not only is its consumption favored by changing tastes, but by economic considerations; while it is more palatable and nutritious than any other animal food, it wastes materially less in cooking. The report on sheep husbandry, made to the Massachusetts Board of Agriculture in 1860, says on this point: "English chemists and philosophers, by a series of careful experiments, find that 100 pounds of beef, in boiling, lose 26½ pounds; in roasting, 32 pounds; and in baking, 30 pounds, by evaporation and loss of soluble matter, juices, water, and fat. Mutton lost, by boiling, 21 pounds; and by roasting, 24 pounds; or, in another form of statement, a leg of mutton costing, raw, 15 cents, would cost, boiled and prepared for the table, 18½ cents per pound; boiled fresh beef would, at the same price, cost 19¼ cents per pound; sirloin of raw beef, at 16½ cents, costs, roasted, 24 cents, while a leg of mutton at 15 cents would cost, roasted, only 22 cents.'.

NO FEAR OF GLUTTING THE MARKET.

The price of prime lamb is still higher than mutton, in all markets. The production of early lambs is, perhaps, the most profitable branch of sheep husbandry. And here the great superiority of the mutton breeds is apparent to all. With South Downs and their crosses more flesh can be made, a higher price secured, a more valuable fleece obtained, and an earlier return of the investment realized, in this branch of the business, than in the slow-going business of wool-growing merely. Nor need there be a fear of glutting the market. Vermont has eight acres of territory for each sheep; Ohio about the same ratio; New York has 11 acres; while the entire territory of the United States could be apportioned into lots of an eighth of a section, or eighty acres to each sheep.

France has a sheep for every four and a half acres of territory, while Great Britain has one nearly twice as large for every two and a quarter acres, and England proper almost as many sheep as acres; and yet the price of mutton is greater there than in any prominent market in the world. An increasing supply in our markets, with increasing excellence in quality, might occasion a rise, instead of a decline, in price.

MUTTON SHEEP AND HIGH CULTURE.

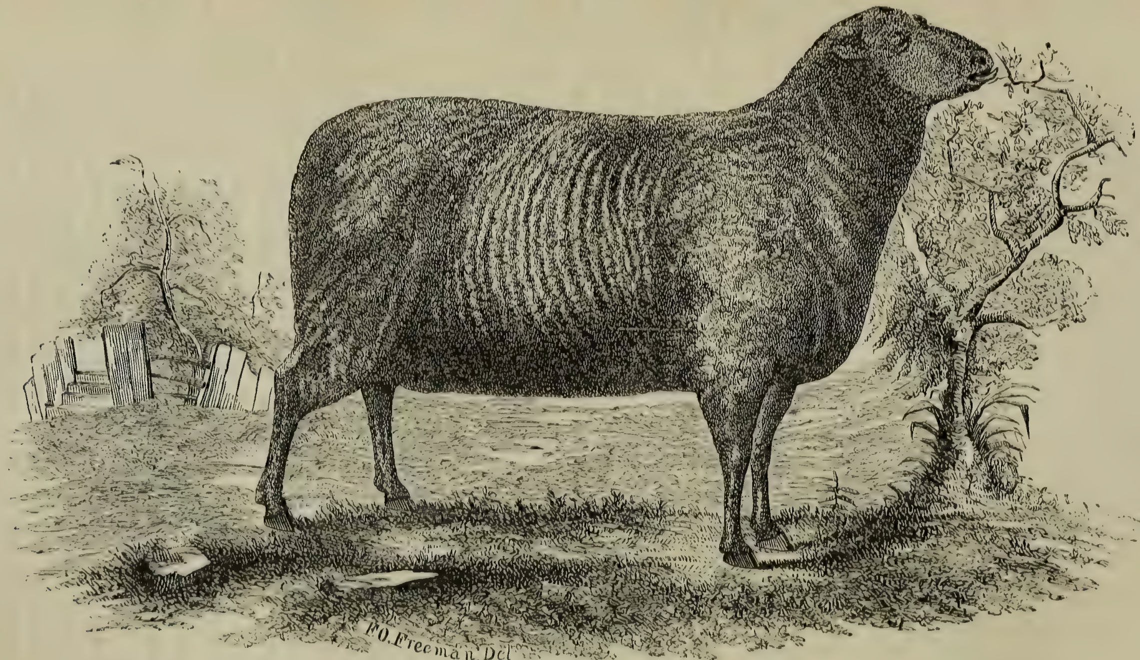
It is interesting to note the change undergone in England during the era of high culture. According to Luccock's tables, revised by Hubbard, the wool of England, not including that of slaughtered animals, was, in 1800, divided as follows:

Short wool	46,434,000 pounds.
Long wool	31,630,560 pounds.

In 1828 the tables were turned upon short wools thus:

Short wool	28,957,200 pounds.
Long wool	63,323,280 pounds.

The decrease of short wool in 28 years was 17,476,800 pounds. The increase of long wool during the same time was 31,692,720 pounds. The average weight of short fleeces was 3.1 pounds; of long, 7.6 pounds, in 1800, according to these tables



Oxford Down Ewe, owned by S. A. Smead, Greenfield, Mass.
Two years old. Weight 170 lbs.
(PHOTOGRAPHED BY ELY.)

The price of labor in this country is an argument, appreciated by every farmer, in favor of mutton sheep. It is stated by the best authority extant on fine wool stock, that it now costs about two dollars per head annually to keep Merino sheep. In South America it costs scarcely a tithe of that sum to produce a fleece; in South Africa wool-growing costs little in labor and pasture, and in Australia the business has vied with the most successful gold-mining in profit, being conducted on a magnificent scale upon the crown lands, with little more of outlay than the necessary care bestowed by a shepherd would require. And even there the question of mutton against wool has been raised. Since the rapid influx of population, according to an English authority, the flocks of New South Wales and Victoria, numbering 15,302,000 in 1855, were reduced to 12,348,022 in 1858, mainly through the instrumentality of butchers.

And the governor general of New South Wales now suggests that "it is desirable to change the kind of sheep, substituting, as in England, an animal with coarse fleece and heavier carcase for the fine-woolled varieties."

India produces eighteen to twenty millions of pounds, and Mr. Wray has estimated its wool-producing capacity at two hundred millions.

The remote regions, it is conceded, are the places from which to obtain fine wools. Countries in which land is valuable and labor high cannot afford to grow wool alone, though the production of mutton and wool combined may still prove a profitable branch of industry. Is this country, with all its broad acres, merely a pastoral region, where high culture may not bless the soil, nor well-paid labor yield a reasonable return? If land may not command a rental of twenty dollars per acre, or more, as in England, is it not freely sold at $100 and $150 per acre in certain localities in New York and Pennsylvania, and at $50 and $75 in Illinois and Ohio and Kentucky? Nowhere are higher wages paid to farm laborers than here; nowhere is the spirit of agricultural improvement more manifestly active; nowhere is the ratio of increase in population so high. Are not these the conditions of a mutton-producing sheep husbandry? Or must we assimilate to the rural industry of Africa and South America, rather than take a rank upon an equality with England, with a determination to exceed her in the skill and profit of our agriculture?

INCREASING DEMAND FOR LONG WOOL.

But there is a relative diminution in the demand for fine wools, which affects the comparative profit of the two systems, and seems to stimulate the production of mutton. The following extracts from the recent work of Mr. Randall, the enthusiastic champion of the Merinos, are significant acknowledgments upon this point.

"In the American market there is a much larger demand for medium than fine wools, and the former commands much the best price in proportion to its cost of production. It is to be hoped, however, that the demand for fine wools will increase."

"American producers of very fine wool have ever fed an expectation, but never obtained the fruition of their hopes."

The average price of Saxon wool has not been more than ten cents higher than prime Merinos. "If we estimate the Saxon fleece," continues Mr. Randall, "at three pounds, and the American fleece at four and a half pounds, when the first was worth in the market $2 10, the latter was worth $2 70." This is placing Saxon at seventy and Merino wool at sixty cents. At the present time good South Down and Cotswolds wool would command almost or quite as much as the Merino; but, setting aside the war demand, when the latter is worth sixty, good medium wools bring fifty, which, at a fair estimate of seven pounds to the fleece for Cotswolds or Oxford Downs, makes the sum of $3 50 a greater stride from Merinos than was made in the case above from the Saxons. One more extract will suffice:

"I am strongly impressed with the opinion that the production of mutton has been too much disregarded as a concomitant of the production of wool. Near large meat markets mutton is the prime consideration and wool but the accessory: remote from such markets the converse of the proposition is true."

Upon this theory, mutton is becoming, year by year, a more important consideration in all the States east of the Mississippi river, for space has been annihilated, and the prairies set down by the largest markets, through the magical agency of railroads, which have been extended from 8,588 miles in 1850 to 30,598 in 1860, an increase of more than 22,000 miles, of which more than 17,000 were in the west and south.

In saying this, it is not intended to intimate that Merinos may not be profitably kept, even in preference to mutton breeds, in certain mountainous localities, difficult of access, or remote from railroads, within the territory east of the Mississippi, such as the mountainous regions in Southern Kentucky and Tennessee, some portions of the Alleghany range, and perhaps the high pastures of the Green Mountains. But sheep husbandry, as a whole, in the populous portions of the States, will undoubtedly tend to the production of flesh and fleece in preference to fleece alone.

PRICE OF LONG AND FINE WOOLS APPROXIMATED.

A constant lessening of the difference in price between fine and long wools is another admonition of the change going on in the direction of the latter.

In 1800 the French Merinos, or royal Rambouillet flock, produced a wool that sold at thirty-eight cents, while the common coarse wool was worth ten or eleven; finer and better wools have borne a still higher price since; but for thirty years past, as will be shown by the statistics of all the wool markets of the world, and very conclusively under another heading, the "Fluctuation of wool values," the tendency has been to depreciation in price of Merino wool, and advance in that of coarse wools. Even the low, coarse, dirty wools of South America and Mexico, have doubled in value in twenty years. The best American families, the finest type of the Merinos, have been improved in size and compactness, securing larger and coarser fleeces, selling at a less price; on the contrary, mutton breeds, with higher feeding, give more lustrous and softer fleeces than in former years, selling at prices almost as high as the fine wools. There is no prospect in the future that the former disparity in prices of wool will ever again exist.

TENDENCY OF WOOLLEN MANUFACTURE.

One reason for this may be found in the rapidly multiplying varieties of new fabrics made from combing wools. In every dry goods establishment may be found evidence of this remarkable change.

There is a quiet, constant setting in of the tide of popular preference for goods made from long or combing wools, such as "moreens," "damasks," "cobourgs," "orleans," "melton," and a great variety of new and popular cloths, including even what are known as "merinos,"—worsted goods, made of wool staple, first combed, to arrange the fibres parallel to each other, and then spun into a small coarse thread.

Almost all of the English wool is made into worsted goods. The old Lincoln sheep, with very long wool, makes a fabric of lustrous appearance, and the Romney Marsh wool has such silkiness and lustre that it is nearly all sent to France for manufacture into beautiful imitations of alpaca and mohair.

Leicester wool is finer, but not so lustrous as the old Lincoln, and is used for worsteds.

Cotswold is very long stapled, of a very harsh character; a combing wool, but not suitable for lustrous goods. It sells at about the same price as Leicester.

The Downs are of short staple, but longer than formerly, and rank in this country as middle wools. The shorter staples are made into flannels and light woollen goods; the longer are used extensively for combing purposes.

The Hampshire Downs have a wool of longer staple than the South Down, of quite uniform quality, somewhat coarser than that of their Sussex relations.

The Shropshires have a wool of similar grade, perhaps a little finer and more lustrous.

The Oxford Downs, like the other cross-breeds, have a wool of longer staple than the South Down, of quite uniform quality, about the same value, and useful for worsted manufactures.

The various families of Merinos, producing fine felting wools, valuable for broadcloths, are almost the only breeds bearing wool of this character. Yet such is the perfection of machinery nowadays, that former difficulties in manufacturing have vanished, and almost every description of goods is made from the different varieties and qualities of improved long wools.

An examination into the woollen manufactures of this country will show, in a conspicuous light, what wools are in greatest demand. The following is a statement of the woollen machinery of New England and New York, showing the quantity and classification:

	Maine.	New Hampshire.	Vermont.	Massachusetts.	Connecticut.	Rhode Island.	New York.	Total.
Satinets	9	3	22	165	112	33	20	364
Cassimeres	28	40	44	285	95	82	103	677
Cotton warp clothes and carp	....	....	....	82	....	....	31	113
Stocking yarn and hosiery	6	12	6	30	74	....	33	161
Worsted and woollen yarn	....	10	....	76	....	8	....	94
Blankets and flannels	40	81	11	185	19	....	33	369
Delaines	....	58	....	67	....	....	....	125
Carpets	....	2	....	62	70	....	47	181
Cashmerets	....	4	....	5	....	....	....	9
Shawls	....	....	....	10	....	7	26	43
Feltings	....	....	....	14	30	....	....	44
Negro clothes and jeans	....	....	....	....	....	53	....	53
Lindseys	....	....	....	....	....	42	....	42
Sundries	8	18	39	18	9	....	148	240
Total number of sets	91	228	122	999	409	225	441	....
Number of establishments	32	56	56	154	93	56	308	....

Mr. George William Bond, who furnished the above table of the "Report of the Boston Board of Trade," in January, 1862, says there are about five hundred sets of cards in the remainder of the free States; and that, so far as he knows, there are no broadcloths made in the United States, except such as are made for the army and navy, though some were made in Massachusetts prior to 1846.

It might be expected that our imports would show a large excess of fine cloths to counterbalance the above showing favorable to long and medium wools. They exhibit, on the contrary, far the greater proportion of worsteds and similar goods, as will be seen by the following compilation of imports of woollens from the treasury returns of the years 1859 and 1860:

	1859.	1860.
Baizes, bindings, and bockings	$136,174	$200,683
Blankets	1,697,386	1,665,181
Carpeting	2,200,164	2,542,523
Flannels	101,911	178,890
Hosiery and articles made on frames	719,415	831,627
Piece goods of wool, including wool and cotton	11,259,693	12,787,754
Piece goods of worsted, including worsted and cotton	12,289,574	15,018,351
Shawls of wool, wool and cotton, &c	2,877,352	2,806,987
Woollen and worsted yarn	386,824	593,371
Manufactures of wool and worsted, not specified	1,853,463	1,311,578
Total of all woollens	33,521,956	37,936,945

It will be seen that, notwithstanding all our finest cloths are imported, the imports of fine piece goods, broadcloths, and cassimeres, including some made of cotton, in part, amount to but 33 per cent. of the importation of woollens.

These figures show with great clearness the remarkable disparity between the consumption of fine wools and of the coarser grades. They also exhibit this difference as constantly widening. It is frequently said that "the world is moving;" the masses are better able and more inclined to seek a more valuable material for clothing; the few rich cease to use alone the finer fabrics, while the many poor are swelling the demand for woollens, yet using mainly the coarser grades of wool, and making wider and wider the disproportion between the consumption of the fine and the long wools. This disproportion will continue to increase.

Nor is this all. The rich and luxurious are giving decided preference, especially in dress goods for ladies, to those of silky lustre, as well as silken softness. This silkiness does not depend on fineness of fibre, but is actually found in perfection only in certain long-woolled breeds. It is a valuable quality, and occasions a difference in value of 25 per cent. over wools of equal fineness, and contributes to the popularity and profit of long-wool growing.

These considerations, all tending in one direction, induce the American farmer to seek a profit in *mutton and wool* rather than in *wool* alone; show him that the conditions of American husbandry in price of lands, cost of labor, advance in scientific culture, and proximity to large and growing mutton markets, assimilate more and more to those under which English flock-masters now labor; prove that the great want of the world for clothing purposes is strong, serviceable, long-fibred, combing wool, and a great deal of it, for the toiling masses of the earth and the middle classes of society; exhibit a growing tendency, as the world grows more enlightened and refined, towards the largely-increased consumption of mutton as an article of food; and impel the sheep-growers of the country to renewed exertions for the improvement of their flocks and the wider dissemination of the best mutton breeds. It is a conclusion in perfect accord with our national impatience at the slow growth and late development of any enterprise, and our desire for speedy returns of money invested, which is at once natural and necessary in view of our prevalent high rates of interest, and the immensity of our resources to be developed.

The future will show, at no distant day, in a light obvious to all, the correctness of these calculations.

THE STATISTICS OF SHEEP HUSBANDRY.

The statistics of sheep and wool, like other results of the census, are defective necessarily, and doubtless more incorrect than they should be by reason of carelessness in making returns. Still, a proximate accuracy is aimed at.

In 1850 the census returned 21,723,220 sheep; in 1860, 22,163.105—increase in ten years, 439,885; an increase of two per cent.* In addition to this number, there were returned by assistant marshals, not included in the regular returns, because not owned by farmers, 1,505,810, making the aggregate 23,668,915.

As compared with the increase of sheep, there has been a proportionally larger increase of wool, indicating a greater weight of fleece. The clip of 1850 was 52,516,959 pounds; that of 1860, 60,511,343 pounds—an increase of 15.2 per cent. This improvement is only a continuation of former progress, which has by no means reached its highest limit.

In 1840, from 19,311,374 sheep were sheared 35,802,114 pounds of wool equal to 1.84 pounds per head.

In 1850, while sheep had increased 12 per cent. in number, the wool crop had augmented 46 per cent., fleeces averaging about 2.42 pounds. The increase from 1850 to 1860 has been respectable, fleeces averaging 2.73 pounds.

Daniel Needham, of Hartford, Vermont, says there was not a buck in that State that could shear 12 pounds in 1840, while there are those now that yield 20 to 25 pounds, of which 60 per cent. is clean wool.

Ohio, which produces the largest amount of wool of any of the States, with 3,942,929 sheep, in 1850, had a wool clip of 10,196,371 pounds, the fleeces averaging 2.58 pounds. In 1860, with 879,042 less sheep, the wool product was greater than in 1850, (10,648,161 pounds,) averaging 3.47 pounds per fleece, or 34.4 per cent. increase in ten years.

In point of numbers, and, in some instances, in aggregate amount of wool, the older States exhibited a decline in sheep husbandry. This decline has been going on for many years in New England, and amounted to 45 per cent. between 1840 and 1850, and 20.4 per cent. in the last ten years. From 2,213,287, in 1850, the decrease has been 496,352.

In the four middle States there has been a diminution of 1,060,109 from 5,463,589, in 1850, or 19.4 per cent.

In the ten southern (Atlantic and Gulf) States there was an increase of 352,709, or 9.1 per cent. from 3,840,124 in 1850. Texas alone gives an increase of 683,088, without which there would have been a loss almost as heavy as the actual improvement. In the fourteen remaining (western) States, in which were 9,781,241 sheep, in 1850, there has been an increase of 1,149,664, or 11.75 per cent.

Making a comparison between the twenty-four loyal and the eleven "seceded States," the showing of the weight of fleeces is conspicuous, the difference being doubtless due in part to climate, in part to careless sheep husbandry. In the former, 16,263,718 sheep produced 50,183,626 pounds of wool, averaging 3.08 pounds each; in the latter, 5,013,059 gave 9,748,702 pounds, or 1.94 pounds per fleece. Virginia, with as favorable natural conditions for sheep husbandry as any other locality, averages 2.40 pounds. Tennessee averages 1.81; Texas, 1.91 pounds.

The following tables exhibit the relative increase or diminution, either in sheep or wool, and the percentage of each in the several States, showing a decrease in sheep in twenty-one States, and an increase in thirteen, with an increase in wool in twenty-one States, and a decrease in twelve, Kansas reporting none in 1850.

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* This differs from the summary in the preliminary report of the census, which contains an error of 1,154,651 in the return for Indiana. Other errors, affecting slightly the aggregates for States, will be corrected in the revised and complete census report.

Comparison by States—Sheep.

States.	Number in 1860.	Increase since 1850.	Diminution since 1850.	Percentage of increase.	Percent'e of diminution.	No. of acres to each sheep.
Alabama	369, 061	....	2, 819	....	00. 6	87
Arkansas	202, 674	111, 418	....	122	....	164
California	1, 075, 718	1, 058, 144	....	....	....	112
Connecticut	117, 107	....	57, 074	....	32. 7	25
Delaware	18, 857	....	8, 646	....	31. 4	71
Florida	29, 958	....	6, 647	....	28. 5	1, 266
Georgia	512, 618	....	47, 817	....	8. 5	72
Illinois	775, 230	....	118, 813	....	13. 2	45
Indiana	1, 002, 724	....	119, 769	....	10	21
Iowa	258, 228	108, 268	....	72. 1	....	136
Kansas	15, 702	15, 702	....	....	....	105
Kentucky	938, 990	....	163, 101	....	14. 7	25
Louisiana	180, 855	70, 522	....	63. 9	....	164
Maine	452, 472	895	....	....	....	42
Maryland	155, 765	....	22, 137	....	12. 4	38
Massachusetts	114, 829	....	73, 822	....	39. 1	43
Michigan	1, 465, 477	719, 042	....	96. 3	....	24
Minnesota	13, 123	13, 043	....	....	....	4, 073
Mississippi	337, 754	32, 825	....	10. 7	....	89
Missouri	937, 445	174, 934	....	22. 9	....	46
New Hampshire	310, 534	....	74, 232	....	19. 2	19
New Jersey	135, 228	....	25, 260	....	15. 8	39
New York	2, 617, 855	....	835, 386	....	24. 1	11
North Carolina	546, 749	....	48, 500	....	8. 1	50
Ohio	3, 063, 887	....	879, 042	....	22. 2	8
Oregon	75, 936	60, 554	....	393	....	802
Pennsylvania	1, 631, 540	....	190, 817	....	10. 4	18
Rhode Island	32, 624	....	11, 672	....	26. 3	25
South Carolina	233, 509	....	52, 042	....	18. 2	67
Tennessee	773, 317	....	38, 274	....	4. 7	37
Texas	783, 618	683, 088	....	679	....	193
Vermont	721, 993	....	292, 129	....	28. 8	8
Virginia	1, 042, 946	....	257, 058	....	20. 3	37
Wisconsin	332, 454	207, 558	....	166	....	103

It will be seen that California makes the largest relative gain, with the exception of the State of Texas, which had few sheep in 1850. Oregon comes next, followed by Wisconsin, Arkansas, Michigan, Iowa, and Louisiana. Vermont and Ohio have each one animal to 8 acres. New York allows 11 acres. Minnesota, as yet supplied with fewest sheep, has 4,073 acres to each; the next in the order of the sparseness of sheep "settlement," Florida, Oregon, Texas, Louisiana, Arkansas, &c.

Comparison by States—Wool.

States.	Wool in pounds—1860.	Increase, in pounds, since 1850.	Diminution, in pounds, since 1850.	Percentage of increase.	Percentage of diminution.
Alabama	681, 404	24, 286	....	3. 6	....
Arkansas	410, 285	227, 690	....	124	....
California	2, 681, 922	2, 676, 402	....	....	....
Connecticut	335, 986	....	161, 468	....	32. 4
Delaware	50, 201	....	7, 567	....	13. 0
Florida	58, 594	35, 347	....	152	....
Georgia	946, 229	....	43, 790	....	4. 4
Illinois	2, 477, 563	327, 450	....	15. 2	....
Indiana	2, 466, 264	....	144, 023	....	5. 5
Iowa	653, 036	279, 138	....	74. 6	....
Kansas	22, 593	....	....	....	....
Kentucky	2, 325, 124	27, 691	....	1. 2	....
Louisiana	296, 187	186, 290	....	169	....
Maine	1, 495, 063	131, 029	....	9. 6	....
Maryland	491, 511	14, 073	....	2. 9	....
Massachusetts	377, 267	....	207, 869	....	35. 5
Michigan	4, 062, 858	2, 019, 575	....	98. 8	....
Minnesota	22, 740	22, 655	....	....	....
Mississippi	637, 729	78, 110	....	13. 9	....
Missouri	2, 069, 778	442, 614	....	27. 2	....
New Hampshire	1, 160, 212	51, 736	....	4. 6	....
New Jersey	349, 250	....	26, 146	....	6. 9
New York	9, 454, 473	....	616, 828	....	6. 1
North Carolina	883, 473	....	87, 265	....	8. 9
Ohio	10, 648, 161	451, 790	....	4. 4	....
Oregon	208, 943	178, 755	....	602	....
Pennsylvania	4, 752, 523	270, 953	....	6. 0	....
Rhode Island	90, 699	....	38, 993	....	30. 0
South Carolina	427, 102	....	60, 131	....	12. 3
Tennessee	1, 400, 508	36, 130	....	2. 5	....
Texas	1, 497, 748	1, 365, 831	....	....	....
Vermont	2, 975, 544	....	425, 173	....	12. 5
Virginia	2, 509, 443	....	351, 322	....	12. 3
Wisconsin	1, 011, 915	757, 952	....	298	....

FLUCTUATION OF WOOL VALUES.

A comparison of wool imports, one year with another, during the whole period of our manufacturing history, will show a remarkable series of ups and downs suffered, rather than enjoyed, by both manufacturer and wool-grower. When prices have ruled high, sheep-breeding and wool-growing have been stimulated to great activity; then, after a very short period of prosperity, factories have stopped, prices sunk, and farmers have become discouraged, killing their flocks remorselessly for mutton, if fat; for tallow and pelts, if poor. One of the causes of these fluctuations has been the constant tinkering with the tariff by politicians—a cause which can scarcely operate in the future under a necessarily high revenue system. Other causes have existed, leading to diversion of capital and labor to other branches of husbandry, as such in turn has realized its term of inflation. With wheat, for instance, at one period given away at thirty-seven cents, rising to one dollar, and at times sold at two dol

lars, it is not strange that the high price should draw all husbandry towards the fatal vortex of exclusive wheat-growing. So with other pursuits of agriculture.

Ohio, the largest wool-growing State in the Union, furnishes a striking example of this fluctuation in numbers and value. In the southern part of the State, particularly, the short-horn mania has made the production of beef an all-absorbing pursuit, increasing the number of cattle from 18,332,224 in 1850, to 25,450,744 in 1860, with a still larger proportionate enhancement of value. This has detracted somewhat from efforts towards improvement in wool-growing. The Western Reserve, on the northern border, has, during the same period, greatly enlarged its cheese-making operations, with a corresponding diminution of its wool production. The following table may be taken as a fair illustration of such fluctuation throughout the country:

Number and value of sheep in Ohio.

Year.	Number.	Total valuation.	Value per head.
1850	3, 812, 707	$1, 984, 983	$0 52
1851	3, 619, 674	2, 060, 012	56
1852	3, 059, 796	3, 581, 385	1 17
1853	4, 104, 450	6, 448, 391	1 57
1854	4, 845, 189	8, 031, 854	1 65
1855	4, 337, 943	5, 664, 829	1 30
1856	3, 513, 680	5, 009, 410	1 42
1857	3, 276, 539	5, 357, 275	1 63
1858	3, 377, 840	4, 755, 215	1 40
1859	3, 366, 073	5, 442, 984	1 61

In 1850, when the price was ruinously low, the number began to diminish; the following year saw little improvement, and the number still fell off; in 1852 the number was still lower, but the minimum was reached, for prices began to appreciate, being double the previous valuation; and in 1853 so patent was the stimulus of enhanced prices that more than a million was added to the previous figure, and almost an equal addition the following year, when a retrograde again commenced. Increased weight and superior quality had something to do with the improvement in prices, particularly during the fluctuations of later years.

The following table, prepared by George William Bond, esq., of Boston, exhibits the value of Ohio wool in October of each year, from 1840 to 1861:

Prices of Ohio wool.

Years.	Fine.	Middle.	Long.	Years.	Fine.	Middle.	Long.
1840	$0 45	$0 36	$0 31	1851	$0 41	$0 38	$0 32
1841	50	45	40	1852	49	45	40
1842*	....	....	....	1853	55	50	43
1843	41	35	30	1854	41	36	32½
1844	42	37	32½	1855	50	42	34
1845	36½	30	26	1856	55	47	37
1846	34	30	26½	1857	56	47	41
1847	47	40	30	1858	53	46	36
1848	32	28	24	1859	58	47	35
1849	41	37	32	1860	54	47	37
1850	47	42	36	1861	4[illegible]	45	50

* Price all round, 33½ to 35 cents.

The price of wool was very low in 1800, and for a few subsequent years, full-blood Merino was worth about one dollar per pound in 1808, and continued high, some of it selling at $2 50 per pound, until the close of the war, when cheap woollens came in, manufacturing being in a primitive state, and prices low until 1824.

The following table, exhibiting the prices of wool in Boston during the period of most substantial progress in manufacturing in this country since 1824, is made from data furnished by George Livermore, esq., an eminent wool merchant of Boston, in his statement of quarterly average prices prepared for "Randall's Fine Wool Husbandry:"

Prices of wool in Boston since 1824.

		Fine.	Middle.	Long.
	Tariff of 1824.			
1824	From July 1 to December 31	60	42	31
1826	From January 1 to December 31	42	38	32
1827	......do..................do	40	42	26
1828	From January 1 to June 30	46	38	30
	Tariff of 1828.			
1828	From September 1 to December 31	51	42	33
1829	From January 1 to December 31	41	34	29
1830	......do..................do	62	52	41
1831	......do..................do	70	59	49
	Tariff of 1832.			
1832	From January 1 to September 30	53	43	33
1833	From April 1 to December 31	66	57	45
	Tariff of 1833.			
1834	From January 1 to December 31	61	51	40
1835	......do..................do	65	58	45
1836	......do..................do	69	59	49
1837	......do..................do	57	47	39
1838	......do..................do	51	44	35
1839	......do..................do	55	49	40
1840	......do..................do	48	40	35
1841	From January 1 to June 30	51	44	36
	Tariff of 1841.			
1841	From July 1 to December 31	48	42	34
1842	From January 1 to September 30	42	37	30
	Tariff of 1842.			
1842	From October 1 to December 31	35	30	25
1843	From January 1 to December 31	35	30	26
1844	......do..................do	46	38	31
1845	......do..................do	41	35	30
1846	......do..................do	40	33	27
1847	......do..................do	46	39	30
1848	......do..................do	36	32	26
1849	......do..................do	43	37	30
1850	......do..................do	45	38	32
1851	......do..................do	46	41	35
1852	......do..................do	49	43	37
1853	......do..................do	57	51	47
1854	......do..................do	45	40	34
1855	......do..................do	49	38	34
1856	......do..................do	57	48	41
1857	From January 1 to June 30	58	52	41

Prices of wool in Boston since 1824—Continued.

		Fine.	Middle.	Long.
	Tariff of 1857.			
1857	From July 1 to December 31	29	31	27
1858	From January 1 to December 31	50	41	35
1859	......do..................do	59	46	38
1860	......do..................do	50	45	30
	Tariff of 1861.			
1861	From January 1 to September 30	44	40	39

FUTURE CONSUMPTION OF WOOL.

It has been shown that more of foreign than of home-grown wool is consumed at present in the United States. It needs but a glance at wool growing and wool manufacturing during the last generation, its extended use in ever-multiplying fabrics of clothing and carpeting, its undiminished demand and appreciated price, to prove that as population increases and civilization advances, the consumption will be largely increased, and the markets of the world long remain unglutted.

In 1860 there were consumed in woollen goods, from our own and foreign looms, at a fair estimate, four pounds of wool to each individual, or 125,000,000 pounds in round numbers. What will be the requirement thirty years hence? In 1860 the population was nearly thirty-two millions. The increase has been quite uniformly about three per cent. per annum, doubling once in twenty-three years. Say that it doubles in thirty years at about two and a half per cent.; in 1890 the population will be 64,000,000, requiring 256,000,000 pounds of wool. Allowing the average weight of the fleece to increase in that time from 2.73 to 4 pounds per fleece by the dissemination of mutton breeds and improved American Merinos, there would be required 64,000,000 fleeces yearly, or 85,333,333, if the fleece should increase only to three pounds, to supply the home demand, before we could calculate upon a single ounce for exportation.

Not only should our home demand be supplied, but there should be a serious attempt to compete eventually for the supply of foreign markets. The product has fallen off in France, in Prussia, in Germany, and in Spain, while it has doubtless reached its highest point in England, in Portugal, in Italy, and other wool-producing countries. In Australia, though the lands nearest the coast, and supposed to be the best, are mostly taken up, and the prices of wild lands and of labor are higher even than in the United States, there are still sheepwalks in the interior valuable despite the drawback of excessive droughts; and the supply may yet be increased.

South America can supply all wools, and has the immense pastures and other conditions necessary for successful fine wool-growing, lacking only the skill and care in management.

The experiment of exportation has already been made, and must in the future prove successful, particularly in fine and in the better class of combing wools. It is claimed by Vermont sheep-breeders, who have travelled over Europe in search of perfection, that they have the best style of Merinos in the world, not excepting Spain.

To show in its various bearings the question of wool demand and supply, home and foreign, the following statistics of the trade are given, beginning with—

Woollens imported from 1821 *to* 1860.

Year.	Value.	Year.	Value.
1821	$7,437,737	1841	$11,001,939
1822	12,185,409	1842	8,375,725
1823	8,268,038	1843	2,472,154
1824	8,386,597	1844	9,475,702
1825	11,392,264	1845	10,666,176
1826	8,431,974	1846	9,935,925
1827	8,742,701	1847	10,998,933
1828	8,679,505	1848	15,240,883
1829	6,881,489	1849	13,704,606
1830	5,776,396	1850	17,151,509
1831	12,627,229	1851	19,507,309
1832	9,992,424	1852	17,573,964
1833	13,262,509	1853	27,621,911
1834	11,879,328	1854	32,382,594
1835	17,834,424	1855	24,404,149
1836	21,080,003	1856	31,961,793
1837	8,500,292	1857	31,286,118
1838	11,512,920	1858	26,486,091
1839	18,575,945	1859	33,521,956
1840	9,071,184	1860	37,936,945

It will be seen that the same fluctuations observed in wool prices have existed in the importations of woollens, affected, no doubt, by periodical inflations and depressions of the national finances, as well as by other causes. The rapid increase is a striking fact, so far exceeding the increase of population.

Wool imported from 1841 *to* 1860.

Year.	Pounds.	Value.	Average value per pound.
1841	15,006,410	$1,091,953	$0 07.2
1842	11,420,958	779,482	06.9
1843	3,517,100	245,000	06.9
1844	14,008,000	851,460	06.0
1845	23,833,040	1,689,794	07.0
1846	16,558,247	1,134,226	06.8
1847	8,460,109	555,622	06.5
1848	11,341,429	857,034	07.5
1849	17,869,022	1,177,347	06.5
1850	18,669,794	1,681,691	09.0
1851	32,548,461	3,833,157	11.7
1852	18,341,298	1,930,711	10.5
1853	21,599,079	2,669,718	12.3
1854	20,200,110	2,822,185	13.9
1855	18,534,415	2,072,139	11.0
1856	14,737,393	1,665,064	11.2
1857	16,502,060	2,125,744	12.8
1858	....	4,022,635	....
1859	....	4,444,954	....
1860	....	4,842,152	....

The treasury schedules, under the operation of the tariff of 1857, did not include the number of pounds. Hence they are not given; nor is the average price per pound

WOOL SUPPLY OF GREAT BRITAIN.

In connexion with this tabular statement, a comparative view of English imports is interesting. The imports of wool into England increase from 1,829,772 pounds in 1771, and 10,914,137 pounds in 1810, at an irregular ratio of advance, very slow until after 1820, rising above 40,000,000 in 1825, thence fluctuating slightly up to 1840. The increase since 1840 has been enormous, rising to 133,000,000 pounds in 1859, of which the British colonial possessions furnished 82,000,000. The home product, from 30,000,000 of sheep, was estimated at 120,000,000 pounds, which, added to the importation, gives 253,000,000 pounds. Compared with the aggregate for 1840, viz: home product, 100,000,000; importation, 46,224,784; total, 146,224,784, an increase of 106,775,216 pounds is shown. Of this, 28,000,000 pounds were exported to France, the United States, and other countries.

Some of the British colonies made an astonishing increase in twenty years. In Australia, from 13,000,000 to 54,000,000; in south Africa, from 1,000,000 to 14,000,000; in the East Indies, from 4,000,000 to 14,000,000.

The rate of increase in British imports is remarkable, as will be seen below:

Year.	Pounds.	Year.	Pounds.
1771	1,829,772	1821	16,632,028
1781	2,478,332	1831	31,652,029
1791	3,014,511	1841	36,170,974
1801	7,371,774	1851	83,311,975
1811	4,739,972	1859	133,284,634

During this period of rapid advance the price of British wool underwent no diminution, but continued to render sheep husbandry one of the most profitable branches of English industry.

THE PRESENT AND FUTURE OF WOOL.

The following statement exhibits the wool exports of the principal wool-producing countries in the world. It should be remembered, however, with regard to England, that the *imports* are many fold more than the *exports*.

Countries.	Pounds.
East Indies	17,000,000
Russia	30,000,000
Italy	92,000,000
Australia	53,000,000
Africa	22,000,000
South America	23,000,000
Southern Europe*	46,000,000
Northern Europe†	35,000,000
Great Britain	16,000,000
Other countries	30,000,000
Total	364,000,000

The present wool consumption of this country is enormously large. Since 1860, during the continuance of the war of the rebellion, a great augmentation of the wool demand has attended the fitting out of more than a million of

* Exclusive of Italy.
† Exclusive of Russia, Prussia, Holland, and Belgium.

armed men, whose clothing is almost exclusively of wool.* And when the war is over, men who have become accustomed to flannels and woollen garments in the field will from choice, if not from necessity, continue their use in the workshop and on the farm.

In 1860, 364,036,123 pounds of cotton were manufactured, costing (raw material) $55,994,735. During the past year especially, a large percentage of this manufacture has been lost to the industry of the country and necessities of the people. King Cotton has been dethroned, and his sudden toppling from his place of pride and power will not only destroy his political prestige, but dim materially the lustre of his commercial fame, and detract from his industrial importance. Other textile products will be patronized, experimented upon, and their use rendered fashionable. Wool, flax, Chinese silk, jute, and other textiles, will evidently encroach heavily upon the domain of cotton. This period, then, would seem to be peculiarly auspicious for enlarged operations in wool-growing. For many years it will be impossible, under any circumstances, to meet the great and constantly growing demand.

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* It is estimated in the wool report of the Boston Board of Trade that 50,000,000 lbs. of wool were used in military goods purchased during the fiscal year ending June 30, 1862—30,000,000 (24,000,000 yards) in army cloths, 13,000,000 in blankets, and 7,000,000 for miscellaneous purposes.

The quartermaster general reports the following among the purchases of that year:

Overcoats	1,281,522
Uniform coats	1,446,811
Pantaloons	3,039,286
Blankets	1,458,808

In the succeeding quarter the following purchases were made:

Overcoats	246,276
Uniform coats	134,997
Pantaloons	766,713
Blankets	894,077

These items would require a consumption of about 13,000,000 lbs. for the quarter ending September 30, 1862; 2,000,000 lbs. more for goods not enumerated would make, in round numbers, 15,000,000 lbs.

From a statement of wool imports for the fiscal year of 1862, furnished to the Department of Agriculture in advance of publication, in the report of commerce and navigation, the following abstract is made:

	Pounds.	Dollars.
Wool, dutiable	40,795,086	6,358,452
Wool, free, from Canada	1,918,793	569,839
Total	42,713,879	6,928,291
Shoddy	6,291,077	442,376

In addition, there were goods imported as follows, weighing and costing as follows:

	Pounds.	Dollars.
Blankets	6,930,196	1,945,707
Cloths, yarns, &c	5,983,989	6,791,677
Carpets, (559,928 square yards)	....	463,461
Total	....	9,200,845
Unenumerated and other goods	....	5,843,220
Total imports of woollen goods	....	15,044,065

It will be seen that the imports of unmanufactured wool, including "flocks" and shoddy, were nearly 50,000,000 lbs., and that manufactured goods, when converted into wool, with due allowance for the waste in cleaning and manufacture, would add nearly 30,000,000, making 75,000,000 to 80,000,000 lbs. in all. To this add the home product, which was at least as much as in 1860, the ten millions lost in the seceded States being fully made up by the increase in the loyal States, and we have not less than 140,000,000 as our supply for the year.

HEALTHFULNESS OF WOOLLENS.

Not alone the casualties of textile production, and the accident of a military demand, but the peculiar sanitary propriety of the increased use of wool will tend to enhance the future consumption. Woollen is peculiarly the clothing of this climate, which is variable and changeable, subject to extremes of heat and cold, which can only be guarded against by changes of clothing to meet the ever-varying temperature, or by a constant use of woollens of different textures. Perhaps the latter course is the more healthful, economical, and comfortable. So excellent a non-conductior of heat is wool, that the uniform temperature of the body is less disturbed by atmospheric changes in the wearing of woollen clothing than in the use of any other material. The concurrent testimony of army surgeons upon this subject is emphatic and entirely conclusive.

Dr. Hall, in the Journal of Health, counsels the use of woollens, saying:

"Put it on at once; winter and summer nothing better can be worn next the skin than a loose red woollen shirt; 'loose,' for it has room to move on the skin, thus causing a titillation which draws the blood to the surface and keeps it there; and, when that is the case, no one can take cold; 'red,' for white flannel fulls up, mats together, and becomes tight, stiff, heavy, and impervious. Cotton-wool merely absorbs the moisture from the surface, while woollen flannel conveys it from the skin and deposits it in drops on the outside of the shirt, from which the ordinary cotton shirt absorbs it, and by its nearer exposure to the air it is soon dried without injury to the body. Having these properties, red woollen flannel is worn by sailors even in the midsummer of the warmest countries. Wear a thinner material in summer."

The same excellent authority cites many points of efficacy in woollen fabrics for military and naval use. He says:

"Even in the hottest weather the entire clothing of the soldier should be woollen; this item is of immeasurable importance, and cannot be too urgently commended to the soldier's attention. In midsummer cotton drawers would be better; but as that involves a useless care of them for a greater part of the year, and as it is settled policy in war to be encumbered with as little baggage as possible, it may be as well to have all the clothing of woollen.

"Just as Lord Nelson's ship was leaving England he discovered that the flannel shirts of the men were six inches shorter than they ought to have been, and refused to go until the proper kind was furnished. He was ridiculed and called 'an old granny.' The result was that, while the rest of the fleet was decimated, he did not lose a single man! and 'his ship in efficiency *was as good as any* TWO *others*!'

"The common observation of all nations leads them to give their sailors woollen flannel shirts for all seasons and for all latitudes, as the best equalizer of the heat of the body."

He gives the following reasons for wearing woollen flannel next the skin in preference to silk or cotton:

"Because it is warmer; it conveys heat away from the body less rapidly; does it so slowly that it is called a non-conductor; it feels less cold when we touch it to the skin than silk or cotton.

"If the three are wetted the flannel feels less cold at the first touch, and gets warm sooner than silk or cotton, and does not cling to the skin, when damp, as much as they do. We know what a shock of coldness is imparted to the skin when, after exercise and perspiration, a linen shirt worn next the skin is brought in contact, by a change of position, with a part of the skin which it did not touch a moment before, often sending a shivering chill through the whole system.

"Another reason why woollen flannel is better is, that while cotton and silk absorb the perspiration, and are equally saturated with it, a woollen garment conveys the moisture to the outside, where the microscope, or a very good eye, will see the water standing in innumerable drops. This is shown any hour by covering a profusely sweating horse with a blanket, and letting him stand still. In a short time the hair and inner surface of the blanket will be dry, while the moisture will be left on the outside."

The following is translated from the French Annales d'Hygiene:

"Diseases of the chest are early contracted by exposure to the cold without sufficient clothing. The greater portion of the children, from one to fifteen months old, who die in winter, are killed by the cold, or diseases resulting from cold.

"The use of woollen clothing in winter is necessary for all, at least about the upper parts

of the body; and, even during summer, the man who from his profession is compelled to work in damp places, and exposed to drafts, should not wear light clothes, or divest himself of them when in a state of perspiration.

"Woollen stockings tend to a very considerable afflux of blood towards the calves of the leg, so that in particular conditions of health their use should at least not be desired; they should be rejected during youth and manhood, but they are of highly valuable service in old age, because then the blood should be checked in its pressure towards the head, and old people generally can scarcely dress themselves too warmly.

"Woollen socks should everywhere be adopted, for cold feet are almost always the cause of catching cold, (catarrh,) and an obstinate cough is often known to cease from the exclusive use of this sort of clothing, so essentially healthy.

"In regard to health, there is generally no risk in wearing warm clothes; on the contrary, they result in great advantage."

Wool is peculiar, among all material used for clothing purposes, as an absorbent of the perspiration, or thrown-off impurities of the body, which are carried to the outside, and thence evaporated. Cotton and other textile materials (good conductors of heat) allow a rapid evaporation directly from the surface of the body, carrying off its latent heat, while leaving impurities upon the skin, chilling the surface, closing the pores, throwing effete matters upon lungs or bowels, or other interior functions, and thus causing all manner of diseases. But wool is the best non-conductor. In a cold, dry climate, the wool becoming wet on the outside, and frozen, acts as a coat of mail, with the further protection of a warm inside lining. It is said that the Scotch highlanders were formerly accustomed, when exposed in cold nights, to wet their plaids before lying down to sleep, and hold them from their bodies till frozen stiff, when they become impervious to cold.

The increasing popularity of woollen goods, shown in the rapidly multiplying styles of fabrics, such as fancy-colored shirtings, light goods of soft wool for summer pantaloons, a variety of long wool cloths for coats and blouses, and heavier cloths of similar textures for over-coats, is strong testimony to the growing appreciation of the superior healthfulness, beauty, and economy of woollens.

Nor is this clothing reform discoverable alone in a gentleman's wardrobe. A lady's toilet now tells of wool—wool of every grade, pile of every style, from the silvery Cashmere, the lustrous Alpaca, and the fine Merino, to the exquisite, soft wools of improved mutton breeds. The garb of pastoral simplicity, once worn by mute emblems of gentleness and innocence, now adorns the impersonation of beauty and purity! From hood to hose, from balmoral to baize, excelling these soft textures in blooming beauty, and radiant with charms that cotton cannot give, the belle of the present day stands forth a living example of the superior healthfulness of wool as an article of clothing. Is this not suggestive of a more glowing picture than that drawn by the Annales d'Hygiene? It says:

"In England, where the children go half naked; where the servants do their work in the morning with their arms naked up to their shoulders, and where the women are always lightly clothed, pulmonary consumption exists in enormous proportion. In London one-fourth of the deaths result from phthisis."

The same authority says that this disease has only prevailed in France since the women wore their hair *a la Titus,* their arms naked, and bosom in a great degree uncovered.

It would be a difficult task to describe the present styles of woollen goods, and combinations of silk and wool, and other mixed woollen fabrics, made for women's wear. It is said by merchants and manufacturers that twice the quantity of woollen goods used ten years ago is now worn by ladies. In the summer, gossamer webs of berage and *berage de laines* are worn, and found to be cooler and more comfortable during the heat of summer, and under the exhaustion of exercise, than cotton goods. *Flannels* are multiplying rapidly—plain, figured, and striped, and increasing in beauty and softness. *Hosiery,*

formerly entirely black, is now made into a multiplicity of styles and a variety of colors, intended to please the eye, as well as to promote the comfort of the wearer. *Balmorals,* the gift of the matronly queen, Victoria, show wondrous ingenuity in many hued shades of beauty, and save the delicate texture of dress from the contamination of the sidewalk, without exposure of garments of ghostly hue, stainless to be sure, but cold and colorless. Then there are the *de baizes* in great variety, mixed goods, but cheap and serviceable; the *mousseline de laines* of American manufacture, rich enough for daughters of princes; *lustres* of silk and wool; *poplins* of similar material, but heavier and dearer; *Coburgs* and other *Merinos* in rich variety; and *cloaking cloths,* light, soft, and fine, of long wools; or else heavy and coarse, with a soft fur-like nap of extreme length; or perhaps a close-textured, solid, fine fabric of the best *Merino.* These latter goods are of every imaginable style, the prevailing tendency being to soft, lustrous, long-woolled goods.

As civilization and education advance, and people learn the principles of hygiene in the school of experience, it might be expected that such a clothing reform would be inaugurated. Hence, with the thick soles and high boots, and other improvements, in place of various barbarisms of female dress, have come in these healthful and beautiful fabrics, intended for the clothing of ladies; and health and fashion have for once joined hand in hand. What has thus been joined let no Parisian milliner recklessly and profanely put asunder! In such an era shall man be arrayed in sheep's clothing, and the prophecy of the poet of a hundred years ago will be fulfilled:

> "Then rigid winter's ice no more should wound
> The only naked animal; but man
> With the soft fleece shall everywhere be clothed."

RAVAGES OF DOGS.

While changing imposts, new and absorbing pursuits in agriculture, the opening up of new farms, the development of one branch or another of our enormous resources, have continuously, as in turn, withdrawn attention from sheep farming, there has been another great drawback to the business. The statistics of Ohio for 1858 show a loss of $109,661 in sheep killed, and $37,097 in sheep injured by dogs; aggregate of $146,758. Other years have shown lighter losses. Last year the loss was heavy again.

Taking the average for Ohio, and calculating upon the census returns of 1860, the entire loss to the United States would be nearly $1,000,000 per annum. This loss, having had its influence in withdrawing capital from wool-growing, is exciting attention among farmers and agricultural periodicals, causing discussion in legislative halls, and eliciting practical acumen and legal lore in drafting dog laws.

Laws should be passed to insure practically the extermination of worthless curs. At present it is a race between sheep and dogs, with a fair prospect, in Rhode Island at least, where the dogs are a little ahead, that the curs will exterminate the sheep. New York has a dog law; so has Massachusetts; and Ohio and other States have legislated upon the subject. In each case some good has resulted, but the cure is not radical. If some red republican should arise with decapitation for his war cry, and the guillotine for his instrument, and rule for a while as a dictator of our sheepwalks, long enough to show the results of his dynasty, no whining poodle would ever be able again "to pull the wool over the eyes" of commiserating farmers. It is to be hoped that more stringent laws, such as will be practical and efficient, will speedily be enacted and enforced in all the States, and thus obviate the almost scandalous acknowledgment, such as is made in the Ohio Agricultural Report, that in twenty-two counties in Ohio, having 811,863 sheep in 1846, there were but

505,226 in 1856—a decrease of more than 300,000, due entirely to the ravages of dogs and consequent discouragement. The injury by dogs in that State will be seen by the following statement:

	No. killed.	No. injured.	Total loss.
In 1858	60, 536	36, 441	$146, 758
In 1859	41, 979	22, 750	102, 398
In 1860	32, 781	19, 001	86, 796
In 1861	31, 750	24, 254	86, 434
In 1862	36, 778	24, 972	136, 347
Total for five years	203, 824	127, 418	558, 733

When such laws are enacted, public sentiment in the rural districts should be educated up to the point of enforcing them rigidly. In this utilitarian age, dogs which cannot be rendered useful, and are not worth the trouble of controlling, should not be tolerated for ornamental purposes.

In the mean time, might not the injury be avoided, in all large flocks at least, by the use of a trained shepherd dog? Many such a dog is daily worth more than the services of a stout boy; on the larger sheep farms in England and Scotland such service of dogs is estimated at $100 each. At $10 for every flock of a hundred or more in this country, the benefit would be represented by a large figure. The principal breeds are the Spanish sheep dog, similar to the Alpine or Bernardine spaniel; the Mexican, probably a descendant of the Spanish; the English drover's dog, and the Scotch colley. Of the latter, Buffon says that he is the true dog of nature, the model of the species; that "he reigns at the head of his flock, and makes himself better understood than the voice of the shepherd. Safety, order, and discipline, are the fruits of his vigilance," and that "he conducts them with an admirable intelligence, which is a part and portion of himself; that his sagacity astonishes, at the same time it gives repose to his master."

It is suggested that the employment of shepherds for the care of large flocks would subserve the interest of the sheep-growers and add to the profits of their business. The care of the sick, attention to young lambs, protection against dogs or wolves, and a constant watchfulness in a score of ways, may prevent loss, and enhance the profits of the owner, on the prairies and the far western plains, (such of the latter as furnish any grasses whatever,) as well as in mountain pastures all over the country—in all places, in fact, where fences are expensive and unusual dangers environ the business. In South America and Mexico, in Scotland, and other parts of Europe, a shepherd is found necessar in Texas shepherds have been employed to advantage. It is usual to plac flock of five or six hundred in the care of one shepherd and his dogs. In Australia the shepherds and stockmen in charge of flocks and herds number about half as many as the former, and the business is there found so profitable that the proprietors, who are squatters on the crown lands, are enabled to live, like princes in England, on their income.

IMPROVEMENT OF PASTURES.

One of the strongest inducements to more extensive sheep husbandry is found in the growing necessity for improvement in pastures. No soil, however fertile, can long sustain the drain of heavy cropping, when these crops are carried from the soil and no equivalent returned. We may assert as we please

and boast of inexhaustible fertility; but our wheat-fields, yielding half the product of English soil, give the lie to our pretensions; and those English farmers, paying rentals equal to the fee-simple of western farms, say they could not pay their rent, and certainly could realize no profits, but for their sheep. Owners of farms on the Southdowns say they could not cultivate them but for sheep. Intelligent farmers in this country will testify to the manurial value of sheep. Mr. Bushnell, of Sheffield, Massachusetts, acknowledges an increase of fifty per cent. in the value of his lands during a period of thirty years engaged in sheep husbandry.

Lawns are kept green if repeatedly shaven. The incisors of the sheep are closer cutters than those of the ox. When the pasture fails for the ox, the sheep can get a good bite, and still thrive. Close grazing cuts the short suckers, and calls forth new ones, succulent, vigorous, and numerous, making a thick carpet of green, and better protecting the roots against drought. Too close feeding, however, may injure the pasture; besides, the sheep, by the peculiarity of its bite, generally loosens the roots of the grass and occasions their spreading. This results from the half-biting, half-tearing action of the teeth in the under jaw, in connexion with the elastic cushion of bars and ridges in the upper jaw. They improve pastures by browsing upon plants and shrubs and eating down wild grasses, and ultimately causing the substitution of the improved and more nutritious grasses for these wild products. Linnæus found, by experiment, that sheep fed upon many more varieties of plants, and rejected fewer, (accepting 387 of 528 species of plants,) than any other animals.

It is acknowledged that English husbandry is dependent largely upon sheep for manuring. That there may be wheat in England, sheep are folded on the wheat-fields, and turnips are grown to feed the sheep. The droppings of sheep are richer in nitrogen than those of the cow, and ferment less easily than those of the horse, containing, by the analysis of Girardin, of water, 68.17 parts; of azotized matter, 23.16; of salines, 8.13. Boussingault makes 36 parts of the excrement of sheep equal to 100 parts of farm-yard manure as a fertilizer. Voided in the form of small, hard, round pellets, it is dispersed among and beneath the grass blades, where it loses little by evaporation until trodden into the earth. Marshall, in his "Survey of Norfolk," calculated that a hundred sheep would fold nine acres a year, and save in manure £22 10*s.*, or 4*s.* 6*d.* per head.

Light, silicious soils, so sandy as with difficulty to be kept from blowing away, are converted into permanent self-sustaining sheep pastures, and eventually prepared for cropping with wheat by the introduction of sheep and white clover. This grass is of a low habit, and peculiar for its tendency to spread and thicken with close grazing. In New England such soils are often improved in this way, and made to yield a profit where profit was thought to be impossible. The native habitat of the Ryland sheep in the counties of Hereford and Gloucester, in England, is upon a soil of red sand, made by abrasion of the "old red sandstone" formation. The region is remarkable for its judicious and profitable husbandry conducted under unusual difficulties.

The improvement of pastures is rapid in proportion to the nutritive value of the feed supplied to flocks. If nourished by grass alone, the flock will return, in accelerating ratio, the virtues of the abundant succulent pasturage. But the time will come, even among the rich pastures of the west, ignored as the idea may now be, when it will be freely conceded that upon the feeding of roots, grain, or oilmeal, one or all, will depend the successful pursuit of sheep husbandry. If grain or oilmeal are fed, they should be given, not only in spring, nor yet in winter, but to some extent in the growing season. And the use of these highly nutritive products will not only add to the weight of the flesh and of the wool, but will enhance greatly the value of the manure, enabling the wool-grower to bring his farm into a high state of cultivation, with much

less expense, and less liability to exhaustion, than with the use of guano or superphosphate. English farmers have testified to the doubling of the value of their lands by the use of oil-cake in summer. One of them, Mr. W. F. Hobbs, says: "Having had experience with regard to some twenty or thirty different manures, I have come to the conclusion that oil-cake, fed the stock depastured, is the best manure for improving first-class grazing lands."

FEEDING TURNIPS.

Scarcity of labor, and cheapness of lands, have prevented to a great degree, in this country, the adoption of a system of green-feeding of flocks in winter. It has been practiced, however, sufficiently to test its value, and must eventually prevail among all successful sheep-breeders.

The kind of roots most profitable in our soil and climate is a subject worthy of careful experiment.* Mangolds, however valuable for cattle, are not desirable for sheep, though some have fed them with advantage. The yellow varieties of turnips are preferred to the white, the Swedes being very popular in England.

Kohl rabi, or turnip-cabbage, has some strong points to recommend its culture in this climate. It is better suited than turnips to a dry, hot climate, is easily transplanted, a heavy feeder, endures drought and frost well. Its nutritious value is much greater than white turnips. Its yield is probably less than that of turnips.

If three tons of Swedes are equal to one of "meadow," or timothy hay, 4½ tons to the acre of Swedes (or seven to eight tons of white turnips) would be a fair equivalent for an average acre of timothy. At forty bushels to the ton, this would be but 180 bushels of Swedes, or about 350 bushels of turnips, to the acre—less than half a crop (if properly tended) of the one, and not a third of a fair crop of the other. Upon this basis the farmer can make his own cal-

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* "The following table," says Richard S. Fay, of Lynn, Massachusetts, "represents the value of different articles of food which may be given to sheep, taking hay of the best quality as the standard:

100 pounds of hay, best quality, is equal to 90 pounds of clover.
100 pounds of hay, best quality, is equal to 102 pounds of aftermath.
100 pounds of hay, best quality, is equal to 374 pounds of wheat straw.
100 pounds of hay, best quality, is equal to 442 pounds of rye straw.
100 pounds of hay, best quality, is equal to 195 pounds of oat straw.
100 pounds of hay, best quality, is equal to 153 pounds of bean straw.
100 pounds of hay, best quality, is equal to 339 pounds of mangold-wurtzel.
100 pounds of hay, best quality, is equal to 504 pounds of common turnip.
100 pounds of hay, best quality, is equal to 276 pounds of carrot.
100 pounds of hay, best quality, is equal to 308 pounds of Swedes turnip.
100 pounds of hay, best quality, is equal to 45 pounds of wheat.
100 pounds of hay, best quality, is equal to 54 pounds of barley.
100 pounds of hay, best quality, is equal to 59 pounds of oats.
100 pounds of hay, best quality, is equal to 50 pounds of maize.
100 pounds of hay, best quality, is equal to 45 pounds of peas.
100 pounds of hay, best quality, is equal to 45 pounds of beans.
100 pounds of hay, best quality, is equal to 105 pounds of wheat bran.
100 pounds of hay, best quality, is equal to 167 pounds of wheat and oat chaff.
100 pounds of hay, best quality, is equal to 45 pounds of linseed oil-cake.
100 pounds of hay, best quality, is equal to 44 pounds of cottonseed oil-cake.

The return in manure, which is not taken into account in fixing these values, is largely in favor of the oil-cake and other highly nitrogenized substances.

"A sheep should receive daily about three per cent. of his live weight in food; if, however, it consists of hay and other coarse herbage, a liberal allowance should be made for waste. Taking the above formula as a guide, one pound of good hay, a half pound of maize, and two pounds of good straw, would be a fair allowance for a sheep weighing one hundred pounds, the three being equivalent to three pounds of hay, or three per cent. of its weight.

"Observation and practice will soon correct over as well as under feeding, the great object being to keep every animal in an improving condition."

culations, and ascertain whether the cheapness of hay, or the high prices of labor, will not be overbalanced, even in the west, by the greatly increased amount of nutriment.

Prodigious crops of turnips, with good culture, may be grown in this country, rivalling the English crops of twenty-eight to thirty-three tons, and even more in exceptional cases, per acre. In Scotland, the average product has been stated at eighteen tons per acre, but the statistics of 1855, with an average of 448,372, give 6,461,476 tons, or nearly 14½ tons per acre. Ireland made an average for eight years, from 1851 to 1858, of 13½ tons per acre. It is a fact lamented by English agriculturists, that the acreage of their crops has never been given; but a still larger product of turnips is estimated (in the absence of government returns) for England proper.

The Scotch generally cultivate Swedes in ridges, say twenty-seven inches apart, and from ten to fifteen inches apart in the row, manuring, as do the English, with farm-yard manure, Peruvian guano, and superphosphate of lime.

Mr. W. G. Lewis exhibited at the South Middlesex (Massachusetts) fair, in September, 1862, German sweet turnips, grown from seeds sent from the Patent Office, of which he produced thirty-seven tons to the acre.

Mr. L. Woodward, of Greenfield, New York, in 1860, produced Swedish turnips at the rate of 1,000 bushels to the acre.

Mr. A. L. McKinstry, of Chicopee, Massachusetts, in the same year, grew 400 bushels per acre, costing 3¾ cents per bushel, manuring with eight dollars' worth of superphosphate, ashes, and plaster.

Mr. S. Edwards Todd, of Lake Ridge, New York, in 1859, obtained 800 bushels per acre, costing less than five cents per bushel.

Mr. Brodie, of New York, gives account of a crop as follows:

To ploughing, $2; cross-ploughing, $2; harrowing, $1; drilling, $1; covering, $1	$7 00
To sowing seed and extra rolling, $2; 2 lbs. seed, 80 cents; cultivating, 75 cents	3 55
To 12 days' thinning, $12; cultivating, 75 cents; 8½ days' harvesting, $8 50	21 25
To 2 days with horse and cart, $3; to rent of land and interest, $6	9 00
Total expense, one acre	40 80

CREDIT—By 1,510 bushels, costing about 2 cents 7 mills per bushel.

At a meeting of the Harvest Club, of Springfield, Massachusetts, held last fall, one gentleman said he had recently harvested 1,200 bushels of turnips from one acre and ninety rods of ground, of a variety between flat and long, costing in their production as follows:

Ploughing $1\frac{90}{160}$ acres	$3 00
Harrowing, bushing, rolling, and sowing	3 00
24 compost loads, half chargeable to crop	12 00
300 lbs. guano	4 50
300 lbs. plaster	50
13 days' gathering and housing	13 00
Total cost	36 00
Value, at ten cents per bushel	120 00
Profit	84 00

But these cases are exceptions. The turnip meets with various and generally

indifferent culture. The yield is far from what it should be. The circulars of the Department, filled and returned from every section of the country, show a remarkable disparity in product per acre; some 100 bushels per acre, very many 200 to 300; 400 to 500 are frequent; and not a few 600 or more. The average is 270 bushels of white turnips per acre, and 385 bushels of Swedes. Mangolds, it may be well to add, show greater productiveness than turnips, averaging 496 bushels. Maine stands first in average productiveness of white turnips, averaging 565 bushels; Minnesota next, 400 bushels; Indiana and Missouri last, 172 bushels. In Swedes, New Hampshire occupies the first place, 606 bushels; Maine next, 553 bushels; Maryland last, 220 bushels. New Hampshire produces the greatest crops of mangolds, 975; Massachusetts, 748 bushels; Kansas, 160 bushels.

These wide differences in the actual product, as shown from careful home estimates of intelligent farmers, are a better commentary on the slovenly and thriftless style of turnip culture in this country than an elaborate treatise. Neglect of manuring, improper soils, and careless preparation of them, readily account for the widest differences.

In balancing the profits of turnip culture, it must be remembered that the superior advantages of variety of winter food for sheep, and of something to take the place of succulent grasses, and the high material value of turnips, have not here been taken into account.

PROFITS OF SHEEP HUSBANDRY.

It would be interesting to examine minutely the relative profit derived from sheep. The length of this essay will prevent any attempt at such analysis here. If sheep will thrive upon three per cent. of their weight daily, and produce flesh worth more in the market than pork, or beef even; if their fleeces, weighing from three to six pounds each, will average forty cents per pound; if they require less care, feed on a greater variety of herbage and shrubs, and eat their food "cleaner" than other farm stock; if they are more prolific, bring their young to the butcher, fat, in less time, and make quicker returns of the farmer's investments, than cattle; if their manure is of more value, and in summer better distributed, than that of any other animal, then it must be evident that a profit exists in their keeping.

Intelligent farmers freely testify to their profit. The venerable John Johnson, of Geneva, New York, says that "what he has made in the last forty years has been, in a large proportion, by sheep." Eastern farmers report a double value of their farms through this instrumentality.

Sheep-breeders will agree with Mechi, the English farmer, in estimating a difference of twenty per cent. between the profit upon sheep and cattle, if their flesh sells at the same price. It is proposed here only to give the statement of certain correspondents, with the results of their own experience, in several sections of the country, under differing circumstances, and with different breeds of sheep. It may, of course, be expected to show, in the several cases, widely different results, illustrating the value of improved sheep very strikingly. The great difference in profit between common Merinos or "natives," at $3, and improved kinds, at $10 to $20 each, is partly owing to increased value in wool and mutton, and partly to their value for breeding purposes, which, if sometimes apparently speculative, is a real value, nevertheless, just so long as the need of improvement and desire for it exist. Improved breeds are found remunerative in extreme latitudes. S. Dinsmore, of Somerset county, Maine, reports that by improvements in breeding he clears $100 per year extra from the same number of sheep kept formerly at the same expense of feeding.

Samuel Bebee, of South Wilbraham, Massachusetts, has published the returns from six South Downs for the following years: 1853, $5 89 per head; 1854, $6 75; 1855, $6 35; 1856, $6 55. The first statement is:

$26\frac{1}{2}$ pounds wool, at 53 cents	$13 78
6 lambs, 462 pounds, at 4 cents	18 48
1 ewe lamb, reserved	3 08
Total	35 34

In 1856 from ten sheep were obtained sixteen lambs, thirteen of which brought $47 55; one buck, reserved, at $5; 31 pounds wool, at 42 cents, producing $13 02, a total of $65 57 = $6 55 per head. One of his ewes, at five years old, had brought nine lambs, eight of which sold at $55.

Horace Clark, of the same place, exhibits the following account of a flock of ten South Downs:

Fifty-two pounds of wool, at 40 cents	$20 80	
Twelve lambs, at $3	36 00	
		$56 80
Cost of keeping, at $1 50 per head	15 00	
Washing and shearing, at 8 cents per head	80	
		15 80
		41 00

This exhibits a gross return of $5 68 per head, and a profit of $4 10 each. This does not take into account the interest on the money invested; neither does it include the manure or improvement of pasture. It should be remembered that these statements give their actual mutton and wool value, without any reference to the price of pure South Downs for feeding.

C. L. Buell, of Ludlow, Massachusetts, from seven sheep obtained seven lambs, and again seven more from the same ewes in seven months after, others producing twins once within the same period. At five months old he obtained $4 each for fat lambs. His fleeces averaged four and a half pounds. They were native ewes crossed with a grade South Down. A contributor of the "Country Gentleman" claims to have obtained from three ewes, in two years, a flock of fifteen ewes; that the wool paid their keeping; and the fifteen sold for $75, the original cost being $14.

It may be said that these facts are exceptions. Then let us refer the subject to the common sense of practical sheep-breeders, for an estimate of average results with large flocks, from their own experience. In answer to inquiries of the cost and product of a flock of one hundred ewes, addressed from this Department to certain flock-masters, responses were received from the following individuals:

Estimate of James E. Bonine, Vandalia, Cass county, Michigan.

100 ewes	$500 00	
Interest on $500, at 7 per cent	35 00	
Interest on 30 acres of land	63 00	
Pasturing, 30 acres	90 00	
Pasturing for lambs since weaning	20 00	
Wintering—6 tons clover	30 00	
Corn, 130 bushels	32 50	
Salt	1 00	
Washing	1 00	
Shearing	5 00	
		$777 50

Brought forward		$777 50
100 ewes	500 00	
607½ pounds of wool, at 47½ cents	288 32	
104 lambs, at $3	312 00	
Manure, in summer	25 00	
Manure, in winter	10 00	
Killing weeds and briers	10 00	
		1,145 32
Profit		367 82

Mr. Bonine's sheep are Merinos. He says he can easily sell choice ewe lambs at $10 to $12 per head, but adds: "That is not my business; I price my sheep at wholesale."

Estimate of W. H. Ladd, Richmond, Jefferson county, Ohio.

100 ewes, at $10	$1,000 00	
Interest on $1,000	60 00	
Pasture, 7 months, at 8 cents per head per month	56 00	
12 tons of hay, at $5	60 00	
4 tons of straw, at $2	8 00	
100 bushels of corn, at 50 cents	50 00	
Salt	2 00	
Labor of feeding, shearing, and care of lambs	50 00	
		$1,268 00
100 ewes, at $10	$1,000 00	
850 pounds gross, minus 340 pounds loss in washing, equal to 510 pounds wool, at 60 cents	306 00	
90 lambs, at $5	450 00	
30 loads manure, at 50 cents	15 00	
		1,771 00
Profit		485 00

Mr. Ladd's sheep are Silesian Merinos. He has averaged eight and a half pounds per fleece for ten years, with a loss of forty per cent. in washing, making washed fleeces average 5.1 pounds.

Estimate of G. F. Quimby, West Salisbury, New Hampshire.

100 ewes, at $3	$300 00	
Pasture, at 50 cents per head	50 00	
15 tons of hay, at $10	150 00	
Washing and shearing	12 00	
Extra attention in lambing time	10 00	
Losses	6 00	
Interest and taxes	20 00	
		$548 00
100 ewes, (15 per cent. depreciation)	255 00	
450 pounds of wool, at 48 cents	216 00	
90 lambs, at $2	180 00	
		651 00
Profit		103 00

This flock is Spanish Merino, a fair average of the common Merinos of New England.

Estimate of B. W. Couch, Warner, New Hampshire.

100 ewes, at $6	$600 00	
15 tons of hay, at $10	150 00	
Grain and roots	50 00	
Pasturing	58 00	
Washing and shearing	10 00	
Interest and taxes	40 00	
Losses	18 00	
		$926 00
100 ewes, (reduced value)	500 00	
600 pounds of wool, at 50 cents	300 00	
90 lambs, at $5	450 00	
		1,250 00
Profit		324 00

This flock is composed of "Atwood" Merinos and their grades, estimated at $6 each, instead of $3 for common; the lambs at $5 each, instead of $2; and the profit $324, instead of $103, as in estimate of Mr. Quimby.

Estimate of Samuel McFarland, Washington, Pennsylvania.

100 Saxon ewes, at $3	$300 00	
Interest on investment, at 6 per cent	18 00	
Pasture, at 50 cents each	50 00	
Hay, at 50 cents each	50 00	
Grain, at 50 cents each	50 00	
Salt, at 4 cents each	4 00	
Washing and shearing, at 6 cents each	6 00	
		$478 00
100 ewes, (decreased value)	275 00	
300 pounds of wool, at 50 cents	150 00	
80 lambs, at $2	160 00	
Manure	10 00	
		595 00
Profit		117 00

This is a Saxon Merino flock. The figures show a pretty heavy cost of keeping for sheep of medium size, a small percentage of lambs, small fleece, a price for wool quite disproportionate to its cost, tending to fortify the prevalent opinion against the profit of excessively fine wool.

Estimate of John S. Goe, Brownsville, Fayette county, Pennsylvania.

100 ewes, at $20	$2,000 00	
Pasture seven months, at 5 cents per head per month	35 00	
Hay five months, at 10 cents per head per month	50 00	
50 bushels oats, at 20 cents	10 00	
Salt, washing and shearing	6 00	
Care	20 00	
Interest on $2,000, at six per cent	120 00	
		2,241 00

Brought forward		$2,241 00
100 ewes, (less three per cent.)	$1,940 00	
100 fleeces, five and a half pounds, at 50 cents	275 00	
50 lambs, at $15	750 00	
20 lambs, at $10	200 00	
10 lambs, at $5	50 00	
10 lambs, at $2	20 00	
Manure	15 00	
Improvement of pasture	5 00	
		3,255 00
Profit		1,014 00

General Goe claims to give a medium price, avoiding extremely low and very high prices. His flock is Spanish Merino. Of course, this estimate is based on the value of ewes and their lambs for breeding purposes.

STALL-FEEDING AND ITS PROFITS.

WHERE IS IT PROFITABLE?

The stall-feeding of cattle is practiced in all sections of the country; the feeding of hogs in the west is the means of marketing western corn; then why should not the production of mutton pay? It does, as examples show, pay largely; yet the practice of feeding sheep is confined to a few, and is almost entirely unknown at the west.

Where should it be practiced? First, in the vicinity of cities, near to large markets, where good mutton is always in demand, and a really superior article will command a price higher than beef. There is no lack of the necessary aptitude to fatten in American flocks; instances are reported in agricultural journals, upon good authority, of a gain of half a pound per day. The price of good mutton, which is usually that which is quickest made, is higher than beef and much higher than pork; therefore enterprising farmers in the neighborhood of cities have long since found stall-feeding of sheep in winter a very pleasant and profitable business. Corn, peas, beans, oats, bran, oil-cake, roots, hay, straw, pea vines, &c., come in requisition, furnishing that variety which is the perfection of economy in fattening animals.

Nor is there good reason for confining this branch of sheep farming to the seaboard or metropolitan suburbs. Large cities are growing up in the west, three of the largest having a combined population of nearly half a million; but aside from this local demand, it can easily be proven that mutton may at least share equally with beef, pork, and whiskey, the profit of the conversion of prairie corn into products bearing transportation. Live sheep have been freighted to New York from the west at a cost of $1 25 each, and sold at $2. These sheep were poor, and thoughtlessly sent to market as a surplus, just as dry pastures and careless tending left them. With three months' feeding upon cheap corn and other abundant crops, their increased weight and better quality of mutton would have easily commanded $5 to $6, say $5 75, or $4 50, besides freight—just six times what they actually netted! It is contrary to all analogy, with other sensible farm operations, to send "sheep frames" a great distance at great expense, when palatable and juicy mutton, tempting to market-goers, might easily and profitably be put upon them, and a saving made of a large quantity of manure, worth all the hay and fodder fed to them. Would store hogs be sent away thus? Would the long-nosed and fast-running land-pikes be found to pay before being modified by corn into conservative and portly porkers?

The report upon statistics to the recent canal convention affirms that the

Illinois farmer realizes but nine cents per bushel for corn sold in New England at sixty cents, or one-sixth of a cent per pound. Then, if it required even twelve pounds of corn for one of mutton, (which it would not with good sheep,) the mutton would cost but two cents per pound. There can be only a question of comparative profit in the case as between mutton and pork or beef and mutton; and there is little doubt that, circumstances favoring, with a breed apt to fatten, a variety of feed, and the added advantage of superior manure, the stall-feeding of sheep in winter will be found largely remunerative along railroad lines throughout the west.

From many portions of the country the business of stall-feeding is reported as a profitable branch of rural industry. In Franklin county, Massachusetts, the average number fed annually in winter amounts to 15,000. In Salem county, New Jersey, according to the correspondence of this Department, 10,000 are annually purchased (a larger number than the permanent stock) by farmers, fed and sold in the fleece to Philadelphia butchers. In New England, New York, New Jersey, and eastern Pennsylvania, the business is quite generally and somewhat extensively carried on, and found more remunerative than the feeding of cattle or hogs.

THE KIND OF SHEEP TO BE SELECTED.

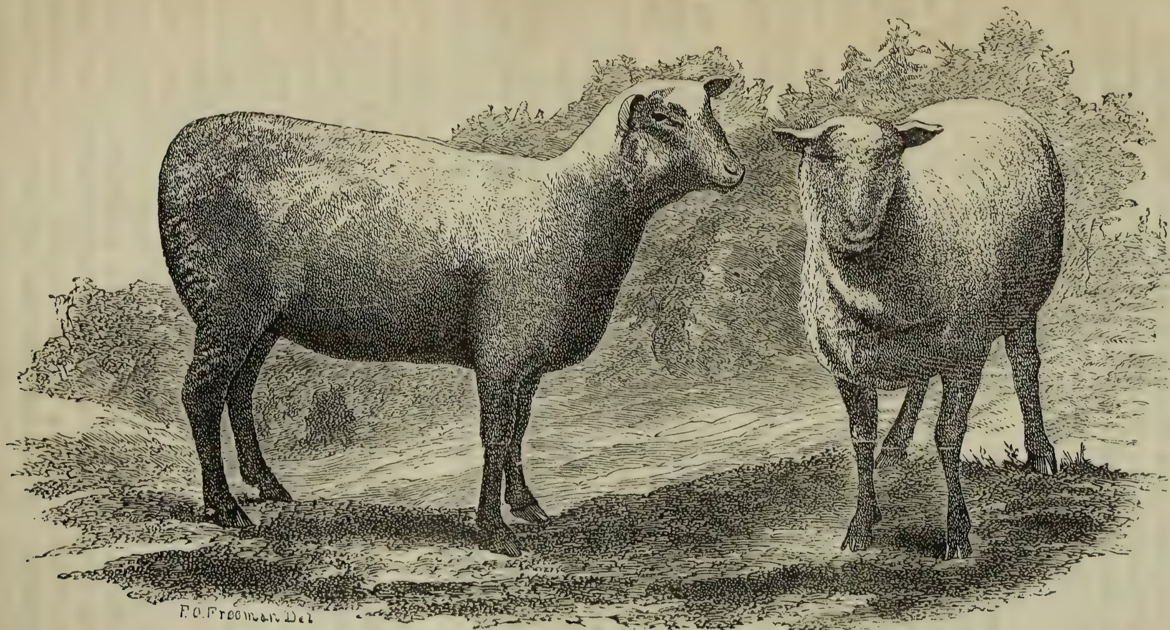
Were there ample supplies of mutton breeds in the country, it would be well to advise their selection at the same price of fine-wool flocks; but wool, as well as mutton, being a valuable consideration, it cannot be entirely ignored, even in calculating the profits of feeding; the fleece, just before the time of butchering, has often, under favorable circumstances, been clipped to great advantage. Good, thrifty, "native" sheep, large enough to receive the desired increase of flesh, and so compact and symmetrical as to insure its being profitably laid on, are properly sought, wherever they can be obtained, at the cheapest rate.

There are very fine mutton sheep obtained from Kentucky, of Down and other rapidly maturing crosses, and also from Canada, which are fattened near eastern markets, while many feeders use the most available selections from common merino flocks. The breed, where they are so mixed and various as in this country, must depend largely upon price and other circumstances. They should be free from disease and in good condition. If perfectly healthy, and in low flesh from deficient keeping, and obtainable at a low price, it may sometimes be good policy to buy such animals. Unless there is too great a disproportion in price, the best conditioned sheep that can be found should be selected.

THEIR MANAGEMENT.

After purchasing, which should be early in the fall, for mutton supplies of the Christmas holidays, and before the commencement of wintry weather for later butchering, immediate efforts should be directed to giving them an early start. The coming of pinching cold upon ill-fed flocks often reduces their vitality, and hinders for some time any perceptible improvement under liberal keeping. As undue exposure, amid severe cold and heavy storms, requires a large portion of the carbon of food to keep up the natural heat of the body, it follows that shelter is equivalent to a certain amount of food, and economical and necessary on that account, to say nothing of the risk to health by extremes of temperature.

Sheep should not be too closely confined or kept too warm; should be allowed a yard for exercise, with a constant supply of water, and an occasional taste of salt. Well-covered sheds, open to the south, are found to answer a good purpose, even in the climate of Canada. The yard should be kept dry with straw, or corn fodder, from which the sheep have closely eaten the blades. The feed it is useless to prescribe with particularity, only there should be a



Imported Southdown Ewes. (Sheared.)

(FROM PHOTOGRAPH.)

proper proportion of fat and flesh-forming substances, as beans and oil-cake, peas and grain, clover hay and corn; feeding with highly-concentrated food the less nutritious and more bulky products, always including a proper proportion of roots, which not only give bulk, but such variety as is most conducive to the health of the digestive organs.

It is a good rule to feed little at a time and often. Some practice feeding a little hay and grain, with turnips afterwards, three times per day. Others feed hay three times daily, with grain morning and evening, and roots at noon. Success has attended feeding oats in the straw with turnips, alternating with turnips and peas in the straw. Very rapid fattening may be assured with clover hay and turnips, morning and night, with a half pound of oil-cake and a pint of barley per head at noon. Feeders have secured a gain of ten to twelve pounds per month, with oats and corn in addition to straw and hay.

In short, stall-fed sheep require a dry bed, shelter from storms, airy quarters, water at will, salt frequently, food often, and in small quantities; thus kept, they will prove healthy, free from vermin, apt to fatten, and profitable.

PROFITS.

It is not proposed to do more than hint in this place at some of the sources of profit in stall-feeding. One of its incidental advantages is found in the fact that it furnishes an interesting branch of industry for the winter months, when ordinary farm operations are suspended, and gives opportunity for valuable experiments in feeding which may yield a rich harvest in the general economy of winter keeping of farm stock. It also furnishes a convenient market for surplus farm products, and effects a saving in freightage similar to that which the manufacturer secures by using raw material upon the ground upon which it was produced. It is especially economical in comparison with cattle feeding, as it uses to advantage a greater variety of products.

One of its most positive and valuable phases of profit, east or west, in sterile or fertile districts, is assuredly found in the valuable fertilizer with which it supplies the farmer. It is a point on which all intelligent farmers will agree, but one which American farmers are very apt to ignore. English farmers understand the matter practically. They estimate the value, to them, of manure, from a ton of clover hay fed to sheep, at $9 64; from a ton of Indian corn, at $6 65; from a ton of peas, $13 38; from a ton of beans, $15 75; and from a ton of oil-cake, $19 72, which is little less than the price usually paid for cake at the oil mills of Ohio. In England, where hundreds of thousands are annually fattened for sale, fertilization is the sum total of expected profit. Feeders pay more per pound in the fall than they obtain in the winter or spring; they must feed sheep to consume their turnips, and without turnips they could scarcely procure a sufficiency of manure. On the contrary, our farmers can often buy in the fall for half the price per pound that is easily realized for fat sheep. A multitude of examples could readily be adduced.

John Johnston, of New York, once purchased several hundred Merino sheep at an average of $1 81. They were fed through the winter with half a pound of oil-cake and three-fifths of a pound of corn each per day, in addition to wheat or oat straw, at an expense of $1 63 per head for corn and cake, and sold in the spring at $6 each. This is $3 56 for straw, care, and profit—enough to satisfy any reasonable expectations.

A farmer in Springfield, Vermont, with a flock of 123, a cross of Saxon with Merino, (which ought to be regarded as furnishing a severe test of stall-feeding,) made a gross gain of $4 50 per head, and a net profit of $1 30 in feeding 20 tons of English hay and 200 bushels of corn.

The present Commissioner of Agriculture once purchased 200 sheep at $600, fed them four or five months, and sold them in the Philadelphia market for an aggregate of $2,500.

Facts might be multiplied indefinitely to prove the superior economy of sending hay, grain, fodder, and roots to market on four legs, and even to show that farmers can buy grain and other feed, sell it to their stock, and make a profit on the trade. It may not be safe in this country to follow the extreme example of the successful English experimenter, Mechi, who purchases several thousand bushels of grain yearly, in addition to his roots, peas, and beans; but experience has demonstrated the economy and profit of stall-feeding of sheep.

PROFITS OF EARLY LAMBS.

In close connexion with the stall-feeding of sheep comes the furnishing of early lambs of the best quality for the butcher. It is one of the most interesting and profitable branches of sheep husbandry in locations accessible to market. A few brief suggestions upon this subject are here offered:

When carried on as a special business the production of butchers' lambs usually involves the annual selection of ewes for the purpose, which requires no little judgment in securing good nurses, possessed of vigorous constitutions—wide-hipped, broad, short-legged, early-maturing animals, the best that can be culled from the common flocks of the country. If the ram commences running with them in September, they will begin to drop their lambs early in February, and continue into March. They should have good pasturage. If short cropping attends the coming of winter, the careful shepherd will eke out the scanty herbage with corn, oats, or their equivalent, that they may enter upon dry feeding and the cold season in good condition. Then they are fed with hay and a little grain or roots. The winter feed, however, it is needless to add, can be varied greatly, and a reasonable variety is found conducive to health. As they approach the lambing season the heaviest should be separated from the flock and fed as before, being careful to give some roots, but not so many as to increase very much the secretion of milk. Breeding sheep should not be too fat; they certainly should not be poor; but the "golden mean" is much nearer the former than the latter extreme. And this may account for the different practice and counsels of sheep-breeders; some affirming that the ewes should be kept on good hay till near lambing time, and then allowed more stimulating food; others preferring to give hay with a little grain all the time, and deprecating any increase of rations. The latter course appears to be more rational upon the whole. When the lambs are three weeks old they will commence eating a little meal sprinkled in the trough, being fed in a separate pen, with an opening too small to admit their dams. At first they are allowed but little, increasing gradually until, at twelve to fifteen weeks old, they are able to eat a quart of meal each per day, when they will have attained sufficient weight and maturity to go to the shambles, and will weigh ten to twelve pounds per quarter, and readily bring from $4 to $6 each. This weight has at least been frequently attained with ease in crosses of the Down family upon "Irish smuts" or black-faced natives. Our best lamb-growers are not satisfied with an increase of less than half a pound per day.

The ewes may be sheared and fattened after the lambs are weaned, and sold at a good profit, thus closing the account with that flock, turning the original purchase and its three-fold increase of lambs, fat and wool, into money in a brief period, producing a large quantity of valuable manure, and enabling the farmer to calculate nicely all the benefits and profits of the enterprise.

STATISTICS OF WOOLLEN MANUFACTURES.

The encouragement of woollen manufactures was so early deemed an object of first importance, that in 1645, two years after the erection of the first fulling-

mill in Massachusetts, the general court of that State passed an order directing all citizens to "endeavor the preservation of such sheep as they have already, as also to procure more with all convenient speed in the several towns, by all such lawful ways and means as God shall put into their hands," enforcing the necessity of such action in the suggestive preamble, "Forasmuch as woollen cloth is so useful a commodity, by reason of the cold winters, and being at present scarce and dear, and likely soon to be so in parts whence we can expect to get it, by reason of the wars in Europe destroying the flocks of sheep, and killing and hindering the trade of those whose skill and labor tend to that end, and as for want of woollen cloth many poor people have suffered cold and hardship and impaired their health, and some hazarded their lives, and those who had provided their families with cotton cloth (not being able to get the other) have had some of their children much scorched with fire, yea, divers burned to death."

Nine years later the exportation of sheep was prohibited, as well as their slaughter for the market until older than two years.

In 1656 the selectmen were by special act required to enforce the duty of spinning upon every family not otherwise employed, and "assess" families at "a spinner, a half or a quarter of a spinner," according to circumstances, a full spinner being required to spin three pounds of linen, cotton, or woollen per week for thirty weeks in the year.

Lord Cornbury and other British statesmen, half a century later, deplored this spirit of colonial enterprise, which had produced goods that "any man may wear," and threatened "to hurt England in a little time." "Now," he shrewdly observed in writing from Massachusetts, "if they begin to make serge, they will in time make coarse cloth, and then fine; we have as good fuller's earth and tobacco-pipe clay in this province as any in the world"—a product, in the opinion of Dr. Woodward, of more value to England than the mines of Peru, and of which, its exportation prohibited, Dodsworth could declare—

"Oil-imbibing earth,
The fuller's mill assisting, safe defies
All foreign rivals in the clothier's art."

Domestic manufacture of woollens increased rapidly under the fostering care of legislatures until nearly every family was supplied with a loom. The girls and women did the spinning and sometimes the weaving, while itinerant weavers were frequently employed. From New England and New York the manufacture became prevalent in Pennsylvania and other colonies, fulling-mills abounding at Lancaster, at Columbia, in Chester, Bucks, and other counties, before the revolution.

England, meanwhile, not merely for revenue, but to keep the colonies agricultural States, dependent upon the mother country for manufactures, and tributary to English commerce, imposed those onerous duties which our fathers resisted, refusing to import, and encouraging reliance upon home industry for clothing. As early as 1768 strenuous public efforts were made in the northern colonies to stop importations, with much success, as the following statement of general importations from Great Britain will show:

Year.	New Eng.	New York.	Penn'a.	Md. & Va.	N. & S. Car.	Georgia.
1768	£430,807	£490,674	£441,830	£669,422	£300,925	£56,562
1769	223,695	75,931	204,976	614,944	327,084	58,341

The extreme south actually increased their imports, illustrating their singular preference for a single industrial pursuit, their ruinous policy of dependence

upon foreign states for the comforts and luxuries of commerce and manufactures, and perhaps, also, their tendency to toryism and treason. May not the cherished policy of England, to keep all nations under her commercial vassalage, account for the favor with which she regards southern secession at the present hour?

After the establishment of independence finer manufactured woollens were, by degrees, attempted. In 1789 about five thousand yards of cloth were made by Colonel Jeremiah Wadsworth, at Hartford, Connecticut, some of which sold for five dollars per yard. General Washington, after visiting this mill, wrote of it, "Their broadcloths are not of first quality as yet, but they are good, as are their coatings, cassimeres, serges, and everlastings; of the first, that is, broadcloth, I ordered a suit to be sent to me at New York, and of the latter a whole piece to make breeches for my servants. All the parts of this business are performed at the manufactory except the spinning; that is done by the country people, who are paid by the cut."

The assembly of Pennsylvania recommended to the people to abstain from eating, and butchers from killing sheep in 1775, in consequence of which 20,000 less were killed in '75 than in '74. The congress of deputies, at Annapolis, in the same year, resolved to encourage the breeding of sheep, and promote the manufacture of woollens. The first provincial congress of South Carolina offered premiums for wool cards and woollen cloth. The committee of Essex county, in Virginia, offered a bounty £50 to any person who would produce 500 pairs of men's and women's stockings made in the county. Similar stimulants and encouragements were applied, with considerable success, to the interesting weakling, American manufactures, in all the colonies.

The history of such a beginning and subsequent advancement would be interesting, and it is to be regretted that data for a full view of the rise and progress of this branch of manufacturing are not more generally accessible.

The following table exhibits, as completely as is practicable, the statistics of this progress:

Year.	Establishments.	Capital.	Wool used.	Value of products.
	Number.	*Dollars.*	*Pounds.*	*Dollars.*
1810				25,608,788
1820				4,413,068
1830				14,528,166
1840	1,420	15,765,124		20,696,999
1850	1,559	28,118,650	70,862,829	43,207,545
1860	1,909	35,520,527	80,386,572	68,865,963

In the last ten years there has been an increase of woollen manufactures of fifty-one per cent. The total product in 1860 was $68,865,963, made in 1,905 establishments, of which 453 were in New England, 748 in the middle, 227 in the southern, 479 in the western, and 2 in the Pacific States.*

In this aggregate of $68,865,963, 80,386,572 pounds of wool were used, an excess of 19,875,229 pounds over the entire clip of 1860. This excess was little more than half of the wool importation of that year, the remainder being used to supply domestic manufactures not enumerated in the census. This wool, of low grades mainly, is imported from South America, Mexico, and other countries. Besides this importation of the raw material, there was in

* In "Bigelow's Tariff Question" the following table is given, showing the number of dollars averaged in each of the geographical sections, to each inhabitant, in the products of

1860 an importation of woollen goods to the value of $37,936,945, an excess of $20,785, 336 over the imports of 1850—an increase of 121 per cent.

The wool used in our manufactures may be thus stated:

	1840.	1850.	1860.
United States product	35,802,114	52,516,969	60,511,343
Imports	15,006,410	18,669,794	34,586,657*
Total	50,808,524	71,186,763	95,098,000

Thus, while the imports of woollens have been more than doubled, and those of unmanufactured wools have been increased in a still greater ratio, showing a heavy demand as yet unsupplied by our wool-growers, the increase of the wool crop has been but fifteen per cent., not even keeping pace with the increase of population, which was thirty-five per cent. for the same period.

To displace this foreign manufacture of woollens would require forty millions of pounds, estimating the first cost of imported goods at ten per cent. higher than home manufactures in proportion to weight, the importations embracing a proportion of goods of the finer qualities. Thus, we use 80,000,000 pounds of wool in our home manufactures, 40,000,000 in foreign goods, making 120,000,000, or about four pounds to each individual. It is estimated that our domestic manufactures swell this average to four and a half pounds, or 140,000,000 pounds of wool, requiring nearly sixty millions of sheep instead of less than twenty-five millions, the present number.

The wool-grower of the United States should see in these facts inducements to persevere intelligently and persistently, as well as fearlessly in the enhancement of the wool product of the country.

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manufactures, mining, and the mechanic arts. Mining makes the Pacific average large. The increase during the last ten years is shown:

States.	1850.	1860.
New England	$103 87	$157 88
Middle	71 38	98 51
Western	26 10	37 45
Pacific	142 59	122 69
Mean	59 05	78 86
Southern	10 88	15 95
Grand mean	43 94	60 64

The New England factories being large, using $20,000,000 of capital of the $35,000,000 invested in the business, produced $38,500,080, of which $18,930 was the production of Massachusetts, or more than one-fourth of the entire product.

* Estimated at 14 cents per pound, a little more than the highest average of any previous year, according to deductions from schedules of imports from 1840 to 1857.

SHEEP HUSBANDRY IN THE WEST.

BY SAMUEL P. BOARDMAN, LINCOLN, LOGAN COUNTY, ILLINOIS.

In treating of sheep husbandry in the west, it may be proper to advert to the peculiar claims of this stock upon the attention of western farmers; and in speaking of the west, I have in view the great *prairie west*, now commonly called the northwest.

The whole northwest being almost entirely an agricultural country, its products are of course extremely bulky, as nearly all agricultural products upon which the simplest industry has been exerted must necessarily be. In addition to our products being of great weight and bulk, we are furthest from market (the seaboard) of any section of our country. In view of these two facts, then, it would seem that the product containing the most value in the same bulk and weight, provided circumstances were equally favorable to its production, must have peculiar claims upon our attention. Among the great staples of the United States, *wool* possesses this requisite in the greatest degree, nor can I think of anything produced in a more limited amount, as feathers, beeswax, hops, sorghum sirup, &c., which is superior to wool in this respect. Cotton, which is generally thought to be the most profitable crop raised in our country, possesses no advantages of transportation over wool, not even in these exceptional times, when that staple is selling at fifty and sixty cents per pound. With regard to cotton being the most profitable crop grown in our country, I will remark, in passing, that two able writers, Mark Cockerell, of Tennessee, and George W. Kendall, of Texas, have demonstrated that wool-growing is the more profitable business, even in the cotton States, or at least in their respective States.

I am sorry to state that the farmers of the northwest are marketing by far the most of their bulkiest and heaviest products—wheat and corn. Our wheat and corn has to be marketed not only at the seaboard, but ultimately in Europe. Under the most favorable circumstances, with the Mississippi river open, or in the summer season when we are blessed with river, lake, and canal navigation northward, the cost of getting to market makes a large hole in the proceeds of our grain, and in the winter season, when our grain has to go by rail, it takes nearly half to pay the transportation. With wheat worth sixty-five cents per bushel, it costs one bushel to send another from central Illinois to market. With corn at ten cents per bushel, it takes over six bushels to carry the one to New York. It costs one cent and two-thirds of a cent to send a pound of wool to New York; less than two cents will carry fifty cents' worth of wool to market; to carry fifty cents' worth of corn costs about three dollars. In my own case, I could haul my wool to New York in less time than I could haul the corn I feed to my sheep in the winter six miles to the railroad, and I could also haul the wool to New York cheaper than I could ship the corn by rail. Even in this State, with its more than three thousand miles of railroad, wool-growing is more profitable than wheat and corn, our great items of export. How much more, then, is it in the great portion of the northwest, which does not now, and may not for many years, possess the questionable advantages of railroads with which to market wheat or corn in the raw state?

As far as transportation is concerned, it is no great detriment to live fifty

or one hundred and fifty miles from a railroad, for a man can haul twelve to fifteen hundred dollars' worth of wool with a pair of horses, and three or four thousand dollars' worth with four yoke of oxen. The expense of hauling a crop of wool even two hundred miles, when, as is done in the west, the driver camps, cooks his own food, and baits his cattle on the prairie, is a mere trifle, resolving itself into simply the time spent on the road.

Such is the situation, with respect to transportation, of Minnesota, Iowa, Nebraska, Kansas, and Missouri; and, on this account alone, if for no other reason, wool-growing is the best business for those States.

Iowa has, the present season, purchased from Michigan and Ohio a number of thousands of sheep, and Kansas is stretching forth her hands. Southern Kansas and the southwestern part of Missouri I consider the best sheep country this side of California. I will not except Texas, for although sheep are not fed in that State, our Illinois flock-masters, who have been there, say they ought to be for six weeks at least. Until I learned differently, I would not have supposed that the Ozark mountains, which were plotted so plainly across southwestern Missouri in my school atlas, and which used to loom up in my imagination as loftily as the Alleghany or Rocky mountains, were merely very high table-lands, mostly prairie. Twelve miles southwest of Springfield, Missouri, within five miles of the now famous Wilson's creek, is said to be the summit of the Ozarks, and it is one of the finest of rolling prairies. Flock-masters of Illinois have had their eyes on this part of Missouri for some years, and now that the people of that State seem to be in favor of instituting free labor among them, I expect, should such be her good fortune, to see within a few years her prairies dotted with thousands of Merino sheep. When Missouri becomes a free State, no longer will the finest sheepwalks in the most genial climate of our country go begging at twelve and one-half and twenty-five cents per acre.

It is not worth while in this day to go into any extended examination whether the prairies of the west are favorable to the production of wool. Thirty years' experience has proved not only that such is the case, but also that prairie farmers enjoy peculiar facilities for growing wool, not possessed by those eastern States in which wool is grown to the greatest extent. Not only are sheep equally healthy on western prairies and on eastern hills, but it is a well-settled fact that, for flocks of so large numbers, ours will outstrip and outshear eastern flocks; and, still more, eastern sheep brought west will *outweigh and outshear themselves.*

There are flocks in central Illinois of from two to five thousand head which shear averages of five and six pounds per head.

Some fifteen or twenty years since there was a good deal said by eastern men about deterioration in quality of wool grown on the prairie. Any deterioration growing out of circumstances of climate, keep, or handling, would require years to amount to any perceptible difference; but thus far we have never found that any such deterioration took place; and even if such were the fact, the whole wool-growing history of the country, from the first importation of Merino sheep, has proved that a medium grade—such as is classed in market "three-quarter blood" and "full-blood"—is the most profitable. Even during the fine-wool mania, when Saxony sold at seventy-five cents and one dollar a pound, a coarser grade of Spanish at fifty cents was more profitable. How much more now when wool, coarse as hair, is outselling the finest Saxony six cents on the pound! The fact is, that for some years, even before the present unprecedented high prices of coarse wool, wool-growers, both eastern and western, had paid but little attention to quality, except so far as to keep their flocks of one uniform grade, and that grade only so fine as was compatible with the greatest weight. As far, too, as deterioration goes, two

years' breeding with finer-wooled bucks would counterbalance fifteen years' deterioration.

In case it be said that the wool of western bucks would deteriorate equally with the rest of the flock, I answer that we should have to make occasional pilgrimages to Vermont, which we already do.

I have said that the prairie States—Illinois, Wisconsin, Minnesota, Iowa, Kansas, Missouri, and I may add the Territory of Nebraska—possess peculiar facilities for growing wool not enjoyed by those eastern States which are most largely engaged in the business. The first advantage lies in the greater cheapness of our lands, which enables us to put more money in stock.

Here in the west the profit is not in the amount of land a man has, but in the buildings, fences, farm machinery, and especially stock with which to get the profit *out of the land.* This very cheapness of land has, however, been a disadvantage also to us; for, in grasping after more land, we, as a people, have found ourselves "*land poor.*" Just at present there is no poorer man in the west than he who owns a large farm with but little improvement on it, with the exception of the dubious improvement that it is all "broke," and who, not owning stock, is compelled to grow large crops of grain to sell.

Another advantage we possess over Michigan, Ohio, New York, Pennsylvania, and other eastern States in which wool is now grown to the greatest amount, is the extensive range which lies open to our use in a great share of the far west, and which we use almost exclusively for summer pasturage. This is not, except in one or two of the more western States, either wholly or for any great part, as many eastern people suppose, government land, but owned to a great extent, as the western phrase is, by speculators. With such a range sheep are not compelled to pick over the same ground, day after day, as in enclosed pastures, but are "herded" at will from one to three miles in a different direction each day, so to every point of the compass, depending on one's happy immunity from neighbors. In the greater share of the west this range can be used to advantage six months, and in the more favored portions longer.

Our greatest advantage, however, I conceive to be the cheapness of our corn. The labor of one man in the northwest will produce more corn than the labor of two men in any other section of our country. Cheap corn makes not only cheap pork and beef, but cheap wool also. We winter sheep almost exclusively on shock corn cheaper than eastern men can on hay, and *corn does make heavy wool.*

With these preliminary remarks, I will proceed, according to established precedent, to treat of the summer and winter management of sheep, promising that I will try to refrain from detail, except where I think the *shepherd system* of the west differs from eastern management.

SUMMER MANAGEMENT.

A *good range* is one of thousands of acres of high rolling prairie through which runs a never-failing "branch," whose banks are dotted with small groves. *A better range* is the same territory with the prairie grasses killed out, and blue grass in their stead.

In the east the first thing which properly comes under the head of summer management is the operation of tagging, which is performed on the entire flock before they pass out of winter quarters on to grass. In pasturing sheep on prairie grass, this is unnecessary except with a few sheep. The reason is, that the prairie grasses are more binding in their nature, so that relatively but a few sheep scour. In the west, as soon as the prairie grass starts, the sheep are put on it, no matter how short it may be; for, if the range is wide enough, the sheep will, by travelling over a large territory, and by dint of busy feeding,

become filled by night. By reason of the wide scope of ground they can be put on the grass some days before one unused to it would think there was even a sheep bite. In this latitude we can generally turn on the prairie from the 10th to the 20th of April, depending on the forwardness of the season. In herding, the shepherd turns the sheep out of the fold as soon as light in hot weather, and *follows* them till dark, when they are brought into the fold. Folding is necessary only where wolves and their cousin curs are troublesome.

All that is necessary in herding a "dry flock" is to have a trusty hand who will get his flock out early enough in the morning, keep them out late enough in the evening, and who will not "bunch" the sheep with his dog too long near a peach orchard, or the house where there are other attractions. Before turning out of the fold in the morning, if the shepherd discovers two or three sheep which are scouring, he catches and tags them. The flock is to be salted, at the rate of about forty pounds of salt to the thousand, once a week, choosing a particular day, to which day they soon learn to call the shepherd's attention by unusual bleating. If one has many sheep, it is better, if compelled to raise lambs on the prairie, to herd breeding ewes by themselves.

Raising lambs is the most important, and requires the most skill, care, and attention, of anything connected with keeping sheep. In this the shepherd displays his genius, and gives proof that he is worthy the name. When we are compelled to raise lambs on the range, we prefer not to have them commence dropping before the 1st of May, until the worst cold storms are past, and there is a good bite of grass. It requires much labor to raise lambs on the prairie, especially when all must be folded every night. When from twenty to sixty lambs are coming every twenty-four hours, the shepherd needs assistance in getting the flock to the fold in the evening, and it is necessary, also, that he should be up with them occasionally through the night. It is a good plan, where one is compelled to raise lambs under such circumstances, to have some panels of portable picket fence, the pickets to be five or six feet high, (which will turn any dog or wolf,) with which to make pens, into which may be driven those ewes which have dropped lambs through the day. This avoids the necessity of driving or carrying such lambs up to the fold. If there are twenty or more young lambs dropped during the day, it is better to put them in four or five pens, for ewes having lambs dropped about the same time, if put in the same pen, are frequently puzzled to tell their own; and sometimes two ewes get to owning the same lamb, and by morning the cast-off lamb is dead for want of milk. In such case it might puzzle Solomon to tell which owned, or ought to, the dead lamb, and which the live one. Ewes, as shepherds know, tell their lambs by the scent till they are two or three weeks old, after which they learn their bleat. Ewes which drop lambs through the night in the fold are left in it the next day. Raising lambs on the range requires the best kind of a shepherd—one who is never at fault to tell which lamb belongs to which ewe; who can catch any sheep or lamb without yarding the flock; who can go with but little sleep; who never gets tired, and *who loves the business.*

The most of flock-masters in this State are now prepared with pastures, sheds, yards, and other conveniences, which make "lambing-time" less to be dreaded than formerly, although one of no less labor and watchfulness than in past time. Where we are prepared with sheds and pastures, we do not send the ewe flock off to the range till the lambs are dropped, and all able to travel.

The general practice in central Illinois is to have a large shed into which to put the lambing flock in bad nights, and other sheds into which to put the ewes having lambed. Those ewes which lamb at night are put with their lambs in a yard or pasture by themselves; those lambing through the day are put by themselves, and so from night to day, and from day to night, as long as there are fields enough to keep them separate.

The great art of raising large flocks of lambs consists in keeping them separated as much as possible while the lambs are young. When all the fields have got a bunch of ewes and lambs in them, the oldest bunches are doubled, to make room for younger lots. This arrangement makes it easier for the shepherd to keep the run of them. It is his business to visit these different bunches two or three times a day, to see that all is going right; that all the ewes own their lambs; that none are claiming others' lambs; that all the lambs suck, and if any of them are becoming "pinned," to clean and rub some dry dirt about the anus. The greater part of the shepherd's time is spent at the *factory*, as the large shed in which the lambing takes place is called. On turning his flock out of the factory in the morning he finds (depending on the number of his ewes) from fifteen to fifty lambs, which have dropped through the night. He has now to slip them out of the flock and see that each ewe owns her lamb, and must also watch till he sees every lamb suck. Frequently a ewe's teats are so stopped that a weak lamb cannot draw the milk, in which case the shepherd catches her and starts it, suckling the lamb at the same time. A lamb which gets up when dropped and suckles itself is half raised if proper watchfulness is observed afterwards. In the factory are a number of small pens into which to put ewes which will not own their lambs, or to put ewes having lost lambs, to make them take a twin lamb. This is done by skinning the dead lamb and putting the skin on the live one. As soon as the ewe can be made to own her lamb she is put out with one of the small bunches, first having been marked on some part of the body with red keel, the lamb receiving a corresponding mark. When a ewe owns a "jacketed" lamb she is put out, the jacket hung up over her pen, and, if on trial she proves refractory, the jacket is again put on the lamb, when a second penning for two or three days will generally break her in. With a flock of one thousand or more breeding ewes, it is customary for the shepherd and his assistant to be up by turns a great share of the night. In pleasant weather the lambs are allowed to drop in the feed lot or pasture; but even then the shepherd should be with the flock constantly. I raised one season eight hundred and fifty lambs (mostly April lambs) with only one small straw shed. The lambs had to drop out in the open feed lot, and in stormy weather it took three of us our entire time to get under cover those ewes and lambs which dropped through the day. I recollect one stormy day on which we had about fifty lambs come, every one of which had to be picked up as soon as dropped, carried under the shed, wiped off and suckled. In this State, at present, the most of flock-masters possessing more or less shed room are raising every year earlier lambs. Many of them are now having their lambs to commence dropping in March. Sheds save a great deal of labor in raising lambs, and where, as in some cases, men will not give the labor, they save many lambs. Last April I knew a man to lose one hundred lambs in one stormy night. If he had raised eighty of them up to weaning time, they would be now worth three dollars and fifty cents each, making eighty come to the pleasant amount of two hundred and eighty dollars. With not much over this amount of money I have built two sheds, one of them eighty feet long, twenty-six feet wide, eight feet high at the eaves, with a double board roof, and enclosed on all sides; the other eighty-four feet long, twenty-eight feet wide, with shingle roof, and enclosed on all sides, the two sheds having a capacity of over six hundred sheep. On the night mentioned I lost but nine lambs, having at the time about two hundred and fifty. In the way of building sheds, flock-masters all travel over about the same road, contenting themselves at first with putting up forks and poles covered with straw, and open at one or all sides, which are just a little better than no sheds. They then build board sheds, with board roof, and generally end in putting up good lumber sheds, with shingle roofs, and closed on all sides.

When there is not pasture on the farm sufficient to keep the ewes till after shearing, they are sent off to the range under the care of a trusty shepherd. A ewe-flock requires constant watching to see that no lambs lie down behind a stool of grass, get asleep, and so get left by the flock. A good many lambs may be lost by a careless shepherd from this cause; for a lamb, on awaking and finding itself lost, starts and runs in whatever direction it may happen to take.

We generally make one job of docking and castrating, although, where a large number of lambs are raised, it might be better to make two of it, provided the ewes have been kept in two or more flocks, so there need be no danger of mixing ewes and lambs. The lambs are first caught out from the ewes and put by themselves. The shepherd performs the castration, another hand doing the docking. Three or four hands catch the lambs and bring them up.

In castrating and docking, it is best to commence early in the morning, and have help enough so all may be attended to in the forenoon, as they bleed less when it is cool. With one hand to dock, and help enough to catch, an active shepherd can alter four or five hundred in a long half day.

Washing sheep is generally done in the west from the 20th of May to the 10th of June, with the exception, sometimes, of a fat wether flock which is to be put into an early market, which is washed sooner.

It does not pay in the west to sell a Merino wether with the wool on, as buyers are not willing to allow what the pelt is worth. February and March are the best months in which to market fat sheep, and in March sheep might be sheared in the dirt, put in the box-cars and shipped immediately, so as not to shrink in flesh much; but wool-buyers here discount thirty-three per cent. on unwashed wool, which would counterbalance all advantage gained by selling the mutton at a little better price.

It is not often we can get a "branch" (Yankee brook) with fall sufficient to enable us to wash in a tank, as is practical in many places east. Where one has such a branch on his own farm, and can thus have permanent yards and fixtures for washing, he is very fortunate, as frequently in the west a flock has to be driven five or ten miles to a creek. The most general practice is to drive to some creek, make a yard on the bank, and wash after the old manner. One thousand are commonly washed in a day; and those who have flocks of from two to five thousand, generally make from two to four washings, from a week to ten days apart, depending on their shearing force. This is in order that the wool need not get dirty, as shearing lasts from two to six weeks. It is best to wash the ewe flock first, in order that it may be sheared first, since carrying a fleece late in June is particularly severe on ewes suckling lambs. If the ewes can all be washed in half a day, it is best to leave the lambs at home, either shut up in a shed or small field, so they may be found by the ewes readily when they return; but if it will take all day to wash the ewes, it is best to take the lambs along. The flock is driven into a yard which has a catching-pen on the brink of the stream, into which fifty to one hundred are driven, then caught and tossed in by two men as fast as six to ten can wash. As far as the manipulation and detail of washing is concerned, I don't know that there is any difference east or west, except, perhaps, that it may take more whiskey to the hand in the west.

We cannot get our wool as white, perhaps, as eastern wool, but we can get it as light, *as far as dirt is concerned.* Where, as used to be the case in Illinois, and is now, and will be the case for some years in States west of this, sheep have to be folded from wolves every night, and where they are herded on the prairie, the wool will show a stain of our black soil; but manufacturers have learned that stain is but the ghost of dirt, and, like other ghosts, scares more than it hurts. In other words, they have learned that a stain does not weigh, is easily got out, and is a good handle to buy wool with. As wolves disappear,

thus obviating the necessity of folding, and as one's range comes into blue-grass, thus taking up the whole surface of the ground, so the dust does not rise as it does on the prairie-grass, which, standing in stools, leave vacant patches of bare ground; and as we use more timothy pasture, we can put up whiter—*not lighter*—wool. We are now, in central Illinois, putting up, I will say, nearly as white a clip as the average clip of Ohio, and yet wool-buyers tell us that it is Illinois wool, which we cannot very well deny.

We allow from six to fourteen days, depending on the weather, to intervene between washing and shearing. I have once or twice seen the weather so cold after washing that the oil did not ascend into the wool for the longer time mentioned. Wool-buyers lay great stress on the particular number of days which have elapsed between washing and shearing, yet, at the same time, all of them prefer a clip showing a lively, glistening appearance, in which the style of each fleece is plainly visible, to one presenting a dull look, having that harsh feel and appearance of being all of one poor grade, which characterizes wool shorn before the oil ascends. As some buyers do not know any more than the law allows about the quality of wool, it so happens that such will, on examining one of those early-sheared, dry clips, after applying their lips in an ominous manner to a fleece, discourse wisely on "quarter-blood" wool, and in most serious, solemn, and severe tones of voice, ask the owner of the clip whether he does not use French bucks. Every flock-master wishes his clip should look its best, and it does so look when the oil has ascended sufficiently to give it a lively look and show the style; and, all their talk to the contrary notwithstanding, such a clip "takes" the buyers. I am not recommending letting sheep run without shearing till the wool is saturated with oil, although all my observation has satisfied me that, at the small relative difference in price which has always been made between heavy and light wool, the grower who puts up the heaviest clips makes the most money.

We pay five cents per head for shearing, and good shearers clip from thirty to sixty per day. One hand ties up the wool for five or six shearers. Each shearer, on turning his sheep off the floor, brands it on the rump with the owner's initial letter. We brand also on the shearing-floor old "culls," which are to be sold to die at some one else's expense. The shepherd brings up enough sheep at a time to last a half day. Where the flock is herded on the prairie, those sheared are turned back into it, until the shorn outnumber the unshorn, when the latter are caught out from one half day to another, as needed. We aim to shear each separate washed flock in a week's time. Our wool is bulked in the barn, subject to inspection, for a week or two; then, if not sold, it is sacked. We all prefer to sell wool at our barns. We sometimes ship to New York, Boston, or Providence, and frequently do better than we could have done at home; still most men prefer to make their own sales. We generally make all our business calculations on receiving about so much money at that particular time of the year, and when a man—especially a western man—"wants his money, he wants it." We are always visited by a number of eastern buyers, still we should be happy to see them come in troops—such swarms as settled down on Ohio last June. The west is an easy section to buy wool in, for a buyer finds from five hundred to six thousand fleeces in a barn, and can buy six thousand fleeces of a man who makes wool-growing a specialty, by expending less talk than to buy one hundred fleeces of one with whom wool is but a minor item.

When we ship, it costs, as I have already stated, less than two cents per pound for all rail transportation; and wool can be shipped and sold at an expense of about four cents per pound. In the last, the first job after shearing is to dip the lambs in tobacco water to kill ticks. This is an operation seldom performed in the west, for the reason that sheep are kept fat the year round, and fat sheep scarcely ever are troubled with ticks. A famous shepherd said

to me one day, "Corn kills ticks." The best shepherds with us in Illinois—those who would rather sleep in the sheep-fold than on a good bed—are Germans who have descended through generations of shepherds, and who may be said to be literally born and bred shepherds. From the example of the German shepherds who have preceded them in coming west, but few of them herd by the month, but a year or two; for as soon as they can speak half English, they invest their money in old cull ewes, which, by dint of nursing and sitting up with o'nights, soon reward German care with a flock of sheep. There is now a good number of German shepherds who own from two hundred to twenty-five hundred sheep each. They do not buy any land; but putting all their money into sheep, get near a good range, herd their sheep and raise their lambs through the summer, and in the fall buy tame-grass and corn wherever they can buy cheapest, drive their flock to it, and winter.

We wean lambs at four months old, generally about the first of September. The prairie grasses at this time of the year are too tough and hard to wean lambs on, except it might be a late July "burn." Volunteer wheat and oats do very well, but before we had tame pasture we used to practice sowing rye the last ploughing of corn, and turning the lambs into the field. This is a good way to learn lambs to eat corn before winter sets in, and it is also a very good way to feed lambs all winter. The same rye makes a good pasture for breeding ewes the next spring. At present we like to have a timothy pasture adjoining the corn, into either of which the lambs run at will. It will be a month or two before they eat much corn, but after the corn is put in the shock they nibble at it more. They waste a little corn; but if a man intends to have a good flock of sheep, he must be satisfied not only to give his lambs all they can eat, but some to waste also.

We commence breeding ewes from the 15th of October to the 1st of May, the earliness depending on the amount of shed-room we possess. In speaking of breeding, it may be expected that I should treat of all the different breeds of sheep kept in the west. From what has gone before, any one can see that in speaking of sheep husbandry in the west I have had in view wool-growing and the Merino sheep entirely. I shall say nothing about the management of South Down, Cotswold, Leicester, and other mutton sheep, for the very good reason that I have had no experience in them. Although neither full-bloods nor grades of the different mutton breeds are as yet kept in so large numbers as fine-wooled sheep, still our breeders of pure Downs and Cotswolds—which are the favorite mutton breeds in the west—have distributed a good many sheep over the west in the past three years. I shall take it for granted, which is generally the fact, that, after considerable experience with the different families—Saxony, Silesian, French, and Spanish—of Merino, flock-masters of the United States have settled on the Spanish as best. Our entire flocks are not full-blood although no flock-master will use any but full-blood bucks, and many of them keep a flock of pure-bred ewes, from which to breed their own, and some bucks, to sell.

On a new farm, in a prairie country, all the improvement a man has at first is a sort of house, a prairie-hay-covered rail-pen for a stable, a single feed-lot, a sheepfold, a "shanghai" fence (western term for a two-board fence) strung around his farm, and no division fences. With these *conveniences* a man starts into the sheep business; and let me observe that such improvement is sufficient to start with; not but that he will have to work at great disadvantage, but the sheep will enable him to put on convenient fixtures sooner than I have known men to put on *the sheep*, who were going to have everything just right before they got sheep, and who, having invested all their funds in improvements, are now growing ten-cent corn with which to buy sheep. On such a farm as described, "bucking" is commenced about the fifth of December—the lambs dropping about the first of May. He has good full-blood bucks, and

naturally wishes to make their services go as far as he can. Having but one feed-lot, perhaps his breeding-ewes, wethers, and yearlings are all in one flock. As he does not wish to breed yearlings, he cannot turn in; consequently, must stand his bucks.

Aproning three or four scrub bucks for teasers, he smears their briskets with red lead or venetian red, and lets them run with the flock over night. Getting the flock up into the fold, he makes small pens on one side of it, into each of which he puts a buck. Catching those ewes marked on the rump, he first looks in the mouth to see whether yearlings or not, then takes a look at their shape, quality of wool, amount of oil in the fleece, &c., and decides which buck he wishes to serve her. Allowing the buck to serve her once, he puts a paint spot on a particular part of the body to show what buck served her, and then throws her out. This is continued every morning till the ewes are all served. Ewes stay in heat about twenty-four hours, and frequently one will be found by the teasers; the freshness of the paint spot shows she was bucked the day previous; in this case the attendant catches and puts her out of the pen. When one has a large flock of breeding-ewes, four or five teasers may be put in without the smearing at the time the flock is got up, and they will find ewes in heat as fast as one man can handle them. In standing bucks, I find, or fancy I find, that the lambs come stronger than when the bucks run at will with the ewes. I have sometimes fancied, also, in the spring when lambs first began to drop, that in standing bucks I got more buck lambs, but I find there is but little difference in numbers of buck and ewe lambs in any particular year. Where bucks run with the ewes, an "aged buck" (two years old and older) ought to be allowed not over sixty to eighty, and a yearling forty to fifty; but in standing one can get from one hundred and fifty to two hundred lambs from an aged buck, and not use him up as badly as running with eighty. I have sometimes practiced, when I had not shed-room for all my ewes, marking ewes bucked the first two weeks in lamp-black and oil, those bucked after that with venetian red; this enables me to sort out those ewes which are to lamb first. By marking the ewes on a particular part of the body to show what buck served them, we learn the stock-getting qualities of our bucks. At lambing time the shepherd gives a different ear-mark to forty or fifty lambs of each buck's get, marking them as soon as found, so there need be no mistake; then when their first coat is taken off it is easy to tell whether the sire is valuable or otherwise. By standing bucks, too, one can easily prevent breeding in and in; not that it is necessary to keep a register, as is done by those who breed full-bloods to sell, by which to tell the sire and dam, grandsire and granddam of every sheep, but by inspecting the teeth one can tell from the age (until full-mouthed) at least this much, that such a ewe was sired by one of a certain lot of bucks in such a year, and is to be served by one of later use. Flockmasters in no section have a better appreciation of good stock, or will take more pains to get it. Not a year passes in which they do not use newer, and aim to have better, bucks.

In selecting bucks, the first and most important point to be looked to is shape. I would not care to look into a buck's wool if he is not built right. A Spanish Merino buck should be short-legged, heavy-bodied, pony-made; the head well up, with a pleasant countenance; short-faced, wide-horned, with some folds about the neck; broad in front, full behind the shoulder, broad on the top of the shoulder, showing no withers; ribbed out round, deep in the chest, well let down in the hock, square behind, full in between the hind legs when viewed from behind, and having a wide, flat tail. He should be woolled all over where wool ought to grow; having a good foretop, wool coming up well on the cheeks, and being of good length on the legs down to the knees, (below which a growth of wool is thought a great point by some who think it indicates a heavy fleece, whereby many gudgeons are caught,) of good length

on the belly, and having just so much density as is compatible with good length. In quality it is not worth while to compare samples on a black coat sleeve under a microscope; such quality as will grade "full-blood" in New York is good enough. A good Spanish buck's fleece ought to weigh, *washed*, from twelve to sixteen pounds, and as much more as a man's conscience will allow. As far as quality of wool in a buck is concerned, I could even overlook a little hair about the hip if I could get pounds enough; still, it is not the finest nor always the coarsest-woolled bucks which shear the heaviest. As a general rule, in quality, style, feel, length of staple, &c., get as good quality as is compatible with weight, but *get the weight.* As far as the amount of oil which a buck's wool should show, I have learned that the oiliest bucks—those as "black as a hat," and looking as if pitch had been put on them—are nearly always thin-fleeced, and in spite of their oil are not the heaviest shearers. Such bucks, too, are generally thin in flesh, and cold storms double them up. Their strength runs to grease, instead of flesh and wool. If, other things being equal, by using them I could make my flock shear more pounds, even of grease, I think I would be tempted to do it, but I am satisfied I cannot. Bucks, on the other hand, ought not to be too white on the outside, but greasy enough to show.

WINTER MANAGEMENT.

I suppose it is more particularly in the winter management of sheep that western differs from eastern management. In the west wool-growing is always made a specialty, those in the business being stocked wholly with sheep, and having almost nothing else. The difference between eastern and western winter management arises partly from our keeping, as a general thing, larger flocks, partly from our having less inside fencing, but mostly from the different kind of feed and different manner of feeding. Having large flocks, and but little inside fencing, western men, not only those with new farms, but all, are compelled to feed in larger flocks than is done in the east. Eastern authorities tell us not to winter over one hundred sheep in a flock, which is good advice; but with lumber at western prices it would cost too much to fence off a sufficient number of lots for two to six thousand sheep. In the east the principal feed is hay; in the west corn. They (eastern men) think it a good plan to feed a little grain with the hay; we think that perhaps it might be well to feed a little hay with the grain. They feed hay twice a day and grain once, the kernels being counted out of a peck measure into little three-cornered troughs; we feed, twice a day, as much shock corn as the sheep can eat, or herd on standing corn two hours in each half day. They try to see with how little grain they can get through the winter; we to see how much ten-cent corn we can market. They are inclined to believe corn to be "most too heating;" we think the want of it most too freezing. They know that feeding too much corn kills sheep off sooner; we know that they will shear enough more wool while they do live to buy two or three sheep.

Corn is not only the cheapest feed with us, but also on new farms the only feed. We cut all our corn, putting it in shocks of fourteen and sixteen hills square. We try to cut it all before frost, so as to have fodder in the best possible condition. Where one has no tame grass, he has to feed from five to six months; with plenty of timothy and blue grass pasture, we need not feed much in this latitude before Christmas. We try to make a sheep eat from three to four bushels of corn during the winter when fed corn exclusively. When we have enough feed-lots, we winter in four separate flocks—breeding ewes, wethers, yearlings, and lambs. With but one feed-lot, ewes, wethers, and yearlings are fed together, and the lambs are allowed to run in the field and help themselves. With but three feed-lots, it is better to winter yearlings

with lambs or ewes than with wethers. In feeding corn it is necessary to be from a week to ten days in getting up to a "top feed." It requires, also, judgment in the feeder to regulate his feed according to the weather.

It is best to commence scattering out some ear-corn while the sheep are yet on very good grass, so as to be sure they do not fall off any. I had one year a crop of about five acres of turnips, which, for the cost, was as cheap November feed as I ever had. I sowed about one dollar's worth of turnip seed over a patch of well-rotted, fresh-broke prairie-sod, and harrowed in the seed by driving a flock of sheep over it a few times. In the fall, after the prairie-grass was entirely dead, I drove on a flock of sheep, thinking they could not help but pitch into the fresh, green turnip-tops; but not a sheep would touch them. I drove them back to the fold; got a wagon and filled it with turnips, pulled tops and all. I then made two or three buckets of brine and poured over the load, leaving it over night. The next day I scattered the turnips out in the feed-lot, and in two or three days the sheep had eaten all of them. After that I commenced herding them on the patch, and had no further trouble in getting them to eat turnips. So fond of them did they become, that on being turned out of the fold in the morning they would run all the way to the patch. I herded nine hundred yearlings on the patch three hours in the morning (feeding corn in the evening) for nearly three weeks. They ate the turnips by scooping them out with their teeth, leaving a mere shell shaped like a bowl.

Our lambs we prefer to start into the winter, and frequently carry them through the winter, by allowing them to pass from grass into the corn at will. When put up to winter, it is best to feed part sheaf-oats, as lambs are slow in learning to eat corn on the stalk. When I have sheaf-oats, I prefer to winter lambs almost entirely on them.

For feeding one needs a low-wheeled stout wagon, with a rack from sixteen to twenty feet long and two or three good yokes of cattle.

The manner of feeding is to go into the field with such rig, load up with corn, haul into the feed-lot, and with a stick throw on to the ground as the team walks along. The only drawback, in feeding shock corn exclusively, may be that with heavy corn, such as will make eighty bushels to the acre, sheep do not get "roughness" enough. A good plan, when one has it, is to feed hay enough in the morning to keep the sheep nibbling all day, and in the evening give a liberal feed of corn. Even in this case I would feed all the corn they could eat.

I presume I ought to qualify somewhat my remarks on feeding so much corn. In the first place, with new farms, we have not got tame hay, and making prairie-hay always costs more than it comes to. In the second place, we can grow corn cheaper than we can get the same amount of equally good feed in any other way, for, with our new, rich prairie soil, two-horse corn-planters, and two-horse corn-ploughs, we can tend fifty acres of corn to the hand; and one man's labor in grass-raising and haymaking for the same length of time would not produce as much *equally profitable* feed. In making a new farm, too, a man has his house and stable to build, his prairie to break, his fence to make, crop of corn and wheat to take care of, and numberless other jobs which are necessary to be done before he can get round to sowing timothy. Rome was not built in a day; nor, contrary to the general opinion in a timbered country, can a prairie-farm be made in one, two, or three years, no matter how much money a man has to do it with. I ought to observe, also, that the fodder, when cut before frost, from an acre of large western corn, is of double the amount of the small eight-rowed eastern varieties.

In feeding shock-corn, the feeder hauls, when the ground is solid, those shocks furthest off and such as stand in hollows or flat places in the field, which, in the spring, will take a wagon in all over. Shocks most convenient to get at, those nearest the feed-lots, and such as stand on the highest ground, are left

for feeding in muddy weather in March. Such shocks as were cut up first, and so contain the most and brightest fodder, are reserved for feeding in the coldest weather. If not in too many flocks, and with corn convenient to the feed-lots, one hand can, with three yoke of cattle, feed two thousand sheep. It might be thought by some that in feeding corn on the ground much would be wasted. Such, however, is not the fact; sheep wasting but little; less, I think, than any other stock fed in the same manner. We feed on a prairie or blue-grass sod, and have the fields large enough, so that in a muddy time we can choose a fresh spot. With rolling feed-lots set in blue-grass, one can feed ten thousand bushels of corn and not waste fifty bushels.

Our wheat, when we raise any, we haul from the shock and stack in the feed-lots, and when threshed rick up the straw for the sheep to run to. Our large wheat-raisers generally make a dead loss of all their straw, burning it as soon as the wheat is threshed. For feeding sheep, I consider good bright straw, well ricked, worth fifty cents per acre, which is the price per acre for cutting the wheat. In ricking straw for sheep to run to, the ricks should be built tolerably high, the sides dug out perpendicularly with pitchforks, to keep the sheep from running over the tops of them, and the tops weighted with poles to keep the wind from blowing them over.

Once in two weeks during the winter, such few sheep in the different flocks as do not appear to be doing well are caught out and put into the field (the quarter part of a farm is generally *the field* in the west) where they can run to the shocks and stacks, the growing wheat, grass, &c., and eat when and as much as they please, and are not knocked about by stronger sheep. This is the best hospital one can have.

It is very necessary that sheep be fed at the same time each day. As it takes a feeder the whole day to feed two thousand, it would seem that he could not be otherwise than regular in his feeding. If, however, his sheep are in three or four flocks, he might be very irregular in his feeding, by giving one flock their feed first in the morning one day and last the next. This same irregularity in feeding one flock would cause irregularity in feeding all the flocks. The same flock must be fed in the same order each day. The last flock fed may not get its feed before eleven o'clock in the morning, and its evening feed an hour by sun, but it should be fed only at these times each day.

Water is indispensable to sheep when on dry feed in the winter. It is, also, almost absolutely necessary that they should have water in their feed-lots; for, although they may be driven off to water once, or even twice a day, not one-half of them will drink unless left at the water for two hours. Any one who has handled sheep much has been amused, and frequently vexed, to see how timidly nice and prudish sheep are in the matter of drinking. On driving a flock of sheep which you know are half choked with thirst to the brink of a stream, the most of them will hang back and stand around for an hour before they make up their minds to drink.

Almost any of our western sloughs which go dry in summer will, if ditched, afford water the majority of winters. I have made such answer me in the winter a better purpose in some respects than even a creek. I have a mile of ditch through such sloughs, part of which run through my feed-lots, the ditch being cut five feet wide and two feet and a half deep, which is less trouble to keep open than a creek or a pond. It does not freeze over as readily as a pond, on account of the protection of the banks, and when frozen over is easily broken in, for the reason that the water in a ditch is nearly always rising or falling.

The greater share of our sheep are wintered in the open feed-lot without shelter of any sort. Western flock-masters say give us plenty of shock-corn and we can shed the sheep *on the inside.* It would manifestly be impossible to feed such large flocks under cover with the same labor; not for the greater

part of the winter would there be any necessity for it. I have already remarked that we do build sheds, but our main object is for use in lambing time. To be sure we can and do use the same shed in winter for shelter in wet and stormy nights, but for a great part of the winter, when the ground is dry—no matter how cold the weather may be—would prefer that our flocks should lie out.

At eastern prices of lumber, corn, and labor, I have no doubt we might be converted to believe in sheds and hay. Our best sheds are from eighty to one hundred feet long, twenty-four to thirty-two feet wide, six to eight feet high at the eaves, with board or shingle roofs, and double doors at each end. Such sheds are generally placed at the cornering of two or more fields for convenience of separating ewes and lambs into different flocks at lambing-time. A long shed is more convenient for cutting off with portable panel of fence into separate apartments. Such sheds, too, are very convenient for sorting, marking, bucking, doctoring, and those various handlings which have to be done with sheep in the course of the year, enabling one to do such jobs in rainy weather. There is but one disease of sheep which western flock-masters fear, the scab. I have never known a flock to have the foot-rot in Illinois. Some of our sheep-men in central Illinois have bought—knowing them to be such—foot-rotted sheep in New York and Ohio, and on driving to Illinois the disease disappeared after the first season without doctoring. It may be that driving so great distance in the dust cured it, for I can see no reason why the disease, if once established here, should not be as troublesome as east. I would not advise any one to run any such risk knowingly.

To cure the scab the sheep are dipped in a decoction of tobacco, to which some add a little sulphur, blue vitriol, and spirits of turpentine. In one of the sheds or yards used for sorting sheep a tank five feet long, two wide and three deep, is sunk in the ground to within about one foot of the top of the tank. Close by are hung kettles in which to boil the tobacco. A better plan is to put up a small arch on which to put a steam-box, which may have a sheet-iron bottom. One can boil faster and use less wood, which is an object when one hauls all his wood five or six miles. At one side of the tank a platform is made of tongue and grooved flooring, the lower edge of which rests on the edge of the tank and rises gradually back, making an incline plane. This platform should be some eight feet in width, with a groove at the lower end to conduct the tobacco-water into the tank, and about twenty-four to twenty-eight feet long—two lengths of twelve or fourteen feet flooring. By having it this length it may be divided into two pens by a gate between, which will greatly facilitate the operation of dipping. A low fence is built around the platform to enclose the sheep while dripping; this is left open at the tank-end of the platform, and having, as I said, a gate between the two pens, and having also a gate at the rear end at which the sheep are turned off. Stem-tobacco is made use of, which is purchased by the hogshead of the tobacconists of St. Louis, the old price of which was two cents per pound, but now costing five cents. It is necessary in the commencement that tobacco-water sufficient to fill the tank should have been boiled, and the tank filled (to within a foot of the top) some two or three hours previous to commencing to dip, for the reason that so great a quantity of water remains hot a long time. It is best to dip in tolerably hot water, but if too hot it takes the wool off. The flock which is to be doctored having been driven into the yard, fifty to one hundred are driven into the catching-pen, when one hand catches and puts the sheep over to two others, who take the sheep by the four legs, one at each end, souse him back down, head and ears into the tank, and lifting out set him in the platform pen to drain. They proceed in this manner till the first pen is filled, when the gate is opened and the sheep let into the second pen. When the first pen is again filled, those in the second pen having drained sufficiently, are turned off

and the first bunch turned into their pen. In this manner the flock is gone over, the tobacco kept boiling at the same time, new stems being added from time to time as the juice loses strength, which is told from its becoming light colored, and fresh qualities of the decoction being put in the tank as it becomes wasted or too cool. When the disease shows itself for the first time in the spring it is a good plan to dip once shearing. Dipping with the fleece on is a slower operation, each sheep requiring to be squeezed with the hands, and using up more tobacco. After shearing, three men, with things convenient, can dip one thousand in a day. When the flock is kept on the same range the dipping must be followed up thoroughly every month, the last dipping being as late in the fall as is possible before winter sets in. The disease can be and has been cured by four or five thorough dippings without removing the sheep to a new range, that, too, in flocks of two thousand, and at an expense of not over five to ten cents per head. It is, however, a disagreeable job, and no one but a thorough sheep man would have the patience to go through it.

With regard to the actual profit of wool-growing in the west, I am satisfied that sheep-keeping is by long odds the most profitable branch of farming which is or can be pursued. In making this assertion, I am speaking, not of the present high prices of wool, but have in view the past twenty or more years. For the past twenty years the wool-growers of Illinois—with perhaps the exception of now and then one who has had a diseased flock—have never seen the year (although having sold wool one year as low as twenty-eight cents per pound) in which they have not made money, which is more than can be said of cattle-feeders, hog-fatteners, wheat-raisers, and especially of corn-sellers. Although we generally call the expense of keeping a sheep sixty cents a year in the west, yet I think that still west and southwest of this State (when tame grass shall have been provided) the expense would be still less than this sum, especially when we take into consideration the fact that were large amounts of corn raised in the extreme far west it would be worth comparatively nothing. The expense and receipts of keeping one thousand sheep may be stated, in general terms, thus: that for eighty acres of corn, one man's time through the year in herding and feeding, sixty dollars worth of washing and shearing, twenty to thirty dollars worth of salt, one can get an annual return of three thousand dollars at least in wool and lambs. The average price at which wool has sold in Illinois for the past fifteen years is but a mere trifle under forty cents per pound.

In like manner as the Indianian lost ten thousand dollars by not having the hogs to eat his mast, so is the west losing its millions by not having the sheep to eat the millions of acres of pasture going to waste every year.

Were I going into Kansas to settle, I would rather have five hundred good sheep and no land than one thousand acres of land and no sheep. With the sheep I could soon get the land; without the sheep the land would keep me poor long years.

The further west a man goes expecting to farm, the more important is it that he should grow something which will not eat itself up while on the road to market.

SHEEP ON THE PRAIRIES.

BY HON. J. B. GRINNELL, GRINNELL, IOWA.

THE antiquity of that Spanish proverb, "Whereon the foot of the sheep touches, the land is turned into gold," I am not able to determine; yet its truth many thousands of our countrymen, I know, seek to test. There is a sheep and wool *mania* throughout the northwest, and the caution of many accredited wise men is, that "sheep must go down; these fancy sheep will soon have had their day." The fearful ones remember the "hen fever," and the "*morus multicaulis*" excitement; but these citations are no argument against the animal with the "golden hoof," and the growth of wool as an article of production next in importance to our bread, which now promises so much comfort and wealth for the husbandman of the prairies.

In this article I may advert to the east and the south; of the first, especially, Vermont has proven that good-blooded stock will find both admirers and purchasers.

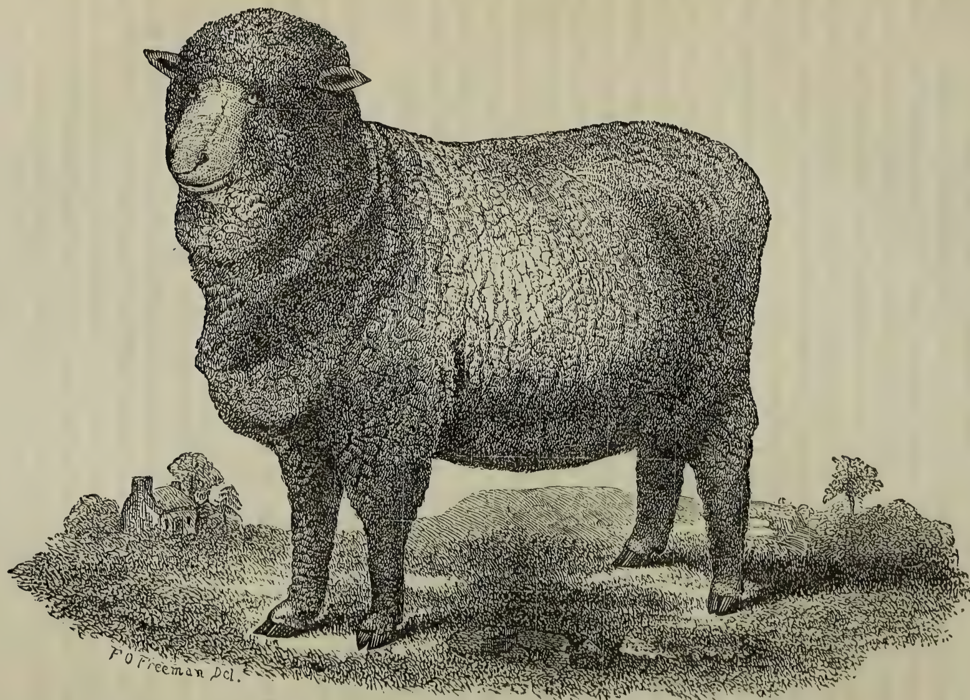
The south has enlisted some of the best writing talent in favor of sheep husbandry; and bold, practical men, under adverse circumstances, have found most satisfactory results in that country; but I have no guide in my attempt to make a plea for the sheep in their adaptation to the prairies; certainly I have seen no paper on the subject in our "Patent Office Reports." The weight of testimony has, until of late, been against our grasses, our climate, and sheep husbandry as an occupation; but the expansion of our population, practical experiences, and national adversity, record facts which have a vital relation to the material interests of the northwest.

The States of Missouri, Kansas, Iowa, Illinois, Minnesota, Wisconsin, and Michigan have expended more than two hundred millions of dollars in the construction of railroads. They have brought life to a thousand cities and villages on the "iron ways," and wealth to such farmers as have found a near market and an easy transportation of their grain to the older States. But the demand for grain is met, the warehouses are full, and in central Iowa wheat is a drug in the market at fifty cents, and corn at fifteen cents a bushel; and the future is not full of promise; our lands are fast being exhausted, and for a wheat market we must depend upon a scarcity in the Old World, and even then the profits must be determined by the carriers and toll-gatherers by sea and land, who fix their rates of transportation as high as is possible and not amount to a prohibition of the products ready for a market.

Not less than a million of farmers seek relief and enhanced profits by a varied agriculture. There is another million of industrial pioneers many miles distant from a railroad, who seek to practice the most obvious principles of domestic economy in raising on their farms those products which can be taken to market for the smallest per cent. of their value.

Pork and beef raising have brought fair returns, and well-directed enterprise anticipates and is prepared to meet the wants of the country for years to come. The prairie States as yet produce not one-fourth the beef and pork they might if labor and population were proportioned to the natural resources of the soil; but even now our eastern friends say, "you of the west have ruined our beef-raising and pork production; it is better to buy than to employ men to till our

PLATE XXXIX.



Pure-bred Spanish Merino Ewe, of Infantado Stock, bred by E. Hammond, Middlebury, Vermont.

(From Photograph for Randall's "Practical Shepherd.")

farms." These products, then, require no stimulation, and we can on mutual terms do as we have, and in other directions *better*.

"*Wherewithal shall we be clothed*" is one of the problems of to-day. Rebellion has diminished the supply of cotton, and raised it in the great markets of the world to almost fabulous prices; and such is the derangement of labor, that an early peace or a compromise would fail to meet, by a production of cotton, a supply equal to the great demand.

It was a reproach to our agricultural interests that in years of peace our production of wool did not keep pace, by at least fifty millions of pounds per annum, with the increasing demands of the country, stimulated by advancing civilization, rational ideas of the need of warm clothing, and the augmentation of our population. The deficiency now must be an appalling fact, painful to all who take pride in our country as on the way to national independence, with unbounded varied production and native resource. And we must submit longer to this in penalty for late-bought wisdom, since a million of men are taken from the ranks of peaceful producers, to form an army, which never saves, but "wastes and wears," as if the best-clothed army in the world had inexhaustible resources.

"King Cotton" aspired to clothe the world, with the aid of a vicious, unnatural system of labor. Right, reason, and the events of the times have hurled from power the pretentious prerogatives, and left for us but the former seat of a king, over whose dethronement there are awakened no emotions kindred to those awakened by the personification of *real* fallen royalty. Our feelings are those of joy, for the great west waits with impatience the inauguration of the reign of the "Prince of Wool." This shall be in the practical realization of that for which our great land is fitted in nature: the raising of "animals with the golden hoof," and the production of a warm and healthful clothing for our people, and a cheap, palatable, and nutritious food.

Our prairie farmers have at a late hour awakened to their real interests; and to meet those who would reproach them for their tardiness, it may be said, in palliation, that in the newer states speculation and not production has engaged a large class. The real pioneers have been occupied with the wheat-field to meet the wants of the family, and produce the largest return from the work of their animals at the plough.

A new country is the paradise of *poor men*, and the high rates of interest, such as are unknown in the east, have rendered the purchase of stock an impossibility. The visitor, too, has coveted so many broad, fair acres which he found money to purchase, that the meeting of taxes and ordinary expenditures has made a demand equal to the full measure of his ability. And then flocks near at hand were out of the question, and the driving them 600 to 1,000 miles from the localities where they were to be found, seemed a forbidding, unprofitable journey. I should mention, too, that numerous and palpable failures alarmed the timid, and put back wool-growing many years. I hear the echo yet of changes rung on the failures in the older counties of this State, and being indisposed to admit the theories of the day, I have been pointed to the bleaching bones of well-bred flocks, and reminded that an easy way to sink a fortune is to go into the "sheep speculation."

Having spoken of the failures, it is fit that I should here account for them. Small flocks have shown a poor increase, for the reason that lambs have been allowed to drop at all seasons, and, as the rule, they were sure to come in the coldest and most inclement months. If thirty per cent. withstood the exposure, it was called "good luck." It was, too, a common practice to "let the sheep run," being sure to find them by the ear-mark for shearing, and at the approach of winter, on a deep fall of snow, in the mean time giving dogs, wolves, and lovers of mutton opportunity to decimate the flock at pleasure. Large flocks have suffered by experimenters, who have made astonishing profits with figures,

on the basis of what has been done with a small flock and good attention; but in the sequel their failures have only proven the truth of the old proverb, "no pains, no gains."

A novice in wool-growing, when making his purchases, asks how *many* for the money, not how *good*, and he gathers his flock in Ohio or Pennsylvania. They are old, or young and ill-bred; if *cheap*, in poor condition, and through dust and under a burning sun they make the journey, worried by dogs and faint from nursing their lambs. Reaching their new prairie home, the frost has been there before them, and the native grasses are worthless. There is no fresh meadow feed, and winter finds the flock poor, unacclimated, and to be further tested as to strength and tenacity of life by late-cured and frost-bitten hay.

As a substitute for the warm sheds enjoyed by the flock the previous winter, they must accommodate themselves to a fence for shelter, (a tight board fence would have been as a luxury;) and the straw sheds which did answer a purpose were often found eaten out or blown away. In these large plans of operations 500 or 1,000 head were kept together as "doing well enough."

Death was sure to make the flock less; and near the "ides of March," when the number was conveniently small by fever and further deaths, the scene would be closed by the discouragement and ruin of the owner, and the knowing nod of the visitor, with the consolatory and explanatory observation that "this is not a healthy country for sheep."

Dr. J. M. Shaffer, Secretary of the Iowa State Agricultural Society, a close observer, and a gentleman of high attainments in many respects, wrote for the public last year: "The wool-growers of Pennsylvania and Ohio settled hereabouts, brought stock with them, and in a short time abandoned the effort, proclaiming that the climate was unfavorable; that the texture of the wool deteriorated; that the winters were very disastrous to the flocks, and the wolves scarcely less so. Did they consider that their sheep had nothing but wild grass for food, and no adequate shelter from the storms, such as they were accustomed to in the older States? We contend that wool-growing could be made a most profitable business here. In no country do tame grasses produce more luxuriant growths. There is plenty of water, abundance of timber for protection, both in its forest state and as affording material for the proper buildings for their protection in the winter. Wherever it has been tried, surrounding the stock with the proper elements for its nutrition and safe-keeping, it has succeeded." This is proof as to failures, and I have a large number of such and varied testimonies, which I forbear to give. "From one know all."

I pass to the question: *What are the inducements to engage in sheep husbandry in the west?* These are of a *peculiar* and a general nature. Those peculiar are found, first, *in the disturbed condition of the country.* The old landmarks of enterprise and labor are removed, and in the midst of changes "we know not what a day may bring forth," while this is certain, that man must, in this clime, continue to be the "clothes-wearing animal," and that cotton, as the material on which our people are to rely, is out of the question. We must have a substitute, and economy and comfort suggest that we place our dependence in wool and flax, both suited to our climate and soil. For the successful use of flax we wait in hope on the promised inventions and improvements of those who will give us the prepared fiber at a low price, and the linen without the distaff, insuring that smooth, strong cloth, of cheap home manufacture, which to sleep on and wear during a large portion of the year, as did our fathers years agone, will be a novelty and a luxury.

Wool is no exotic. Earnestness and skill are the first requisites, and a production of wool equal to the wants of all the dwellers on the continent will be at hand, bringing into use millions of acres of the finest native sheepwalks, now producing grass that is just suited to the flock, which is left unclipped only to be crisped by frosts and swept away by autumnal fires. Disturbed labor

and inadequate production point to a virgin empire in extent, and invite the world to a way of wealth, and to independence of cotton, which secured, cuts the sinews of the rebellion, diversifies our productions, gives scope to rational enterprise, subsistence and hope to those who would find a homestead on the free or cheap lands of the northwest.

At no period in our country's history, all the advantages considered, have sheep lands been as cheap as now. Heavy timber lands required a large outlay before grasses could be grown. Government openings and prairies years ago were at a great distance from railroads or navigable streams. Now the large owners of lands near towns and railways must realize. Reverses have thrown lands, where there are roads, and schools, and society, into market. War has called the best of our farmers from home, and good farms can be had for the tilling and the taxes.

Further peculiar inducements are found in the want of labor. It will require years to recover from this shock to our producing interests occasioned by the war; and there is a practical question, What profitable enterprises require the least labor? Wool-growing is one. The dairy enslaves the household. In pork-raising, swine take the most of their food from the hand or pail. Wheat-raising is a constant tax on muscle, as it is a drain on the soil. Different is the flock that during more than half the year may stroll over the prairies, requiring but the attentions of a boy and dog to keep in advance of the ewes, that they may be folded at nightfall. Little attentions go far in insuring success in sheep husbandry; and even the girls will consider it a pastime and a pleasure to give attention to the lambs. The schoolboy and the invalid, as a recreation, may bestow much of the care required by the flock, and but little is left for sturdy labor. The grass is mown and gathered by machinery and horse-power with such skill that two good laborers are equal to the task of furnishing winter food for a thousand sheep.

Another inducement is found in the present high price of wool. At this writing good wools are in demand at from 60 to 80 cents the pound. It must require years to meet the demand for this staple, and extremely low prices may not be anticipated. The increase, too, will be in demand, which is worth not less, annually, than the wool. A good lamb brings $2, and ordinary store sheep $4 each, and much lower prices will be regarded as remunerative. The inducements to sheep husbandry, which are of a general nature, are found, first, *in the actual profits of the business.* No position is more susceptible of proof than this, that a pains-taking farmer, with a good flock of sheep, is independent. This is his position as a wool-grower in the older States, where the pastures are circumscribed and grain is expensive; where the increase has been of slow sale, and close keeping has given a light clip of wool.

Hon. H. S. Randall—very high authority—who resides in the region of the averaged priced lands in New York and the east, says: "I have kept Merino sheep more than thirty years. * * * The fleeces of the flock (not counting wethers) have averaged over two dollars per annum. On the best lands in the State it now costs about two dollars a head annually to keep a Merino sheep. * * * The lambs and manure are clear gain."

The highest estimate of the cost of keeping a sheep in Iowa, in a flock of 500 or upwards, is not over one dollar, and this embraces high feeding with corn in such a quantity as will contribute to ready maturity, high flesh, and a heavy fleece. This is not the lowest estimate. Favorable contracts for both parties have been made for keeping at 60 cents per head, including washing and shearing. These are my estimates for Iowa on a flock of 1,000 head; that the total cost of hay, straw, corn, ricks, hovels for shelter, washing and shearing, and service of the shepherds, is not over $1,000.

The profits are estimated by a clip of wool, 4,000 pounds, at, say, 40 cents a pound, $1,600. Say 500 lambs, at $2 each, $1,000. These figures, calling

the flock worth $4 a head, and the interest of the capital invested $400, will give a profit which ought to be satisfactory, and the present actual value of wool and the increase would add to the above fully 30 per cent. Profits are further determined by the comparative small cost in transporting wool to the best markets.

At any point two hundred miles from Chicago this ratio of cost in freighting is well established: that to transport your products to the seaboard, on wheat you pay 80 per cent. of its value; on pork 30 per cent.; on beef 20 per cent.; gross *on wool* 4 *per cent.* This is not conjecture, but my own experience, that I give 80 per cent. of the value of my wheat which impoverishes my farm, to find a market; and 4 per cent. to find the best wool market, the production of which enriches my acres beyond computation.

National development and expansion, not less than our independence of cotton and the vicious system of labor which has supported its pretensions to kingship, are involved in the early clothing of our prairies with bleating flocks. We have room and occupation for hundreds of thousands, who should go forth in swarms from our teeming cities to escape crowded garrets and the death damps of cellars. To the young man who believes "the behavior of sheep as fascinating under any circumstances," and finds no room on the "old farm" in the east, we can say: Here is room—an unclaimed area larger by thousands of square miles than the land of Midian, from which the Israelites brought forth three-fourths of a million of sheep as spoils—a range of country from southern Kansas to the latitude of St. Paul, in Minnesota, on the north, as varied in climate and production, and better adapted to the wants of the shepherd than the famed walks of Spain, varying as the southern plains of Andalusia and the northern snow-clad mountains, on and between which extremes there were depastured, with profit, several millions of sheep, the progenitors of our famed Merinos.

The purpose to raise our own wool and to cease importation is not enough. We can export, and prove not only that the best sheep known are in our country, but that our cheap, rich lands, salubrious climate, coupled with American enterprise and skill, are at once the promise of wealth and an attraction to all seeking a home and remunerative occupation.

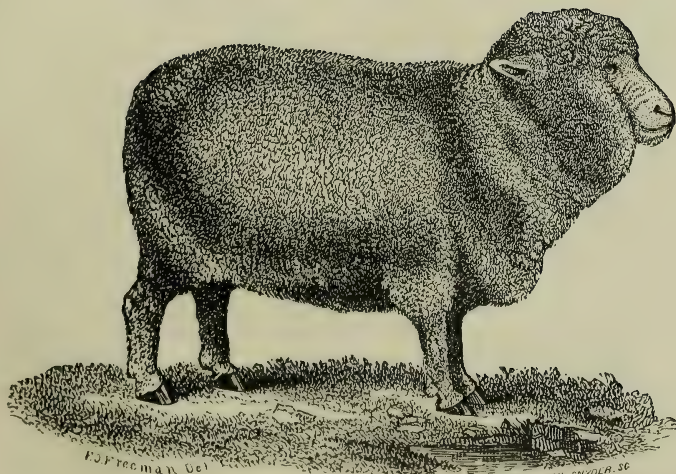
This may be the place to say that the more common and varied use of woollens greatly contributes to general health and comfort. These are the days of *cotton and rheumatism.* We must return to the use of wool in our variable climate. What is health for the soldier may be to the citizen.

The fireman on the steamer, and the sailor in the exposures of heat and storm, clad in woollen, escape the aches and coughs to which the less exposed are subject by the substitution of cotton. This subject of wide dimensions is engaging the attention of the medical fraternity, and there can be no doubt that sanitary reform will look to the more general use of woollen for men in all the ranks and occupations of life.

The extension of sheep husbandry is related to the moral improvement and general culture of our population. Wheat-growers are said to work in the summer to *make* their money; and in the winter, with nothing to do, work as hard to keep from *spending* what they made.

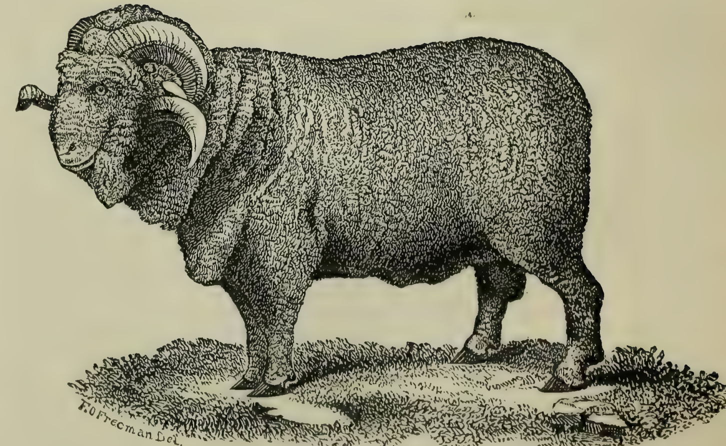
In old "cider-making times" the ludicrous yet truthful account of the late fall and winter work was: In the fall we made thirty barrels of cider, and in the winter "me and the boys drank it up." Different from those enterprises which throw the work into a few months, and then leave the laborer to sink into idleness, sheep give all the year round employment, and the fairest division of labor for all seasons, and yet time for reading, recreation, and rest.

The flock becomes an every-day study—an instructor as to the great laws of animal life and scientific development, and truly contributes to elevation of character, not less than to the unfolding of the wisdom of the Creator, who,



Pure=bred American Merino Ewe,
Owned by Henry F. Pearson, Webster,
Merrimack Co. N.H.

(FROM PHOTOGRAPHS.)



"MONARCH"

Pure=bred American Merino Ram, owned by
John C. Pearson, Webster, Merrimack Co. N.H.
Age 3 yrs, weight 160 lbs.; weight of fleece, 22¼ lbs.

though he had cursed the ground, kept the occupation of Abel—the first keeper of sheep, who "brought of the firstlings of his flock"—in association with wealth, purity, and renown through the centuries of which we have knowledge in the records of sacred and profane history.

Let me not be understood as advocating a great flock for the prairies—an overshowing enterprise which promises an easily-made colossal fortune. All great gains which are material are related to losses of some description; for in every sphere of activity there is a law of compensation linked to us as by the chain of destiny. I would promote home independence, which is formed by diversified labor, and a rational but not unnatural expenditure of energy.

In the great facts of to-day that five noblemen own one-fourth of Scotland; that thousands of square miles of the worn-out tobacco lands of Virginia and the forsaken cotton fields of the Carolinas had *few* proprietors, who worked *many* slaves, there are no suggestions of happiness, social order, and intelligence in the gradations from "the chariot to the plough." I would not emulate those who have become rich by wool-growing in Texas, California, and Australia, compelled to sacrifice neighborhood society, and denied a population dense enough to sustain schools and churches. What is wealth when its accumulation is attended with the relapse of the shepherds and their families into ignorance and coarseness, being lowered often into the scale of the vile by immoral association with "half-breeds" and roving desperados. We abjure the flocks of thousands for single estates, which necessitate nomadic life and a sparse population, and bring a deprivation of these blessings which are at once the bond of neighborhoods and the promise of virtue and intelligence unattained by the shepherd kings in the infancy of our race, never to be enjoyed by those who prefer isolation, and to be "monarch of all they survey," rather than the rural and rival companionship of farm neighbors, however humble.

BREEDS OF SHEEP.

On this topic I have but a few lines, for the books have wide and critical discussions of the various breeds which now enlist the attention of the American shepherd, and newspaper articles by men of experience and comparison have covered the ground which I might otherwise occupy.

James S. Grinnell, esq., now of the Agricultural Bureau, has a learned and critical article on various breeds and their history, in the Massachusetts Agricultural Report of 1860; and the Hon. H. S. Randall has a most practical and exhaustive paper in the last New York State Agricultural Report, on the Merino sheep. Distant from Chicago and large cities in the west, coarse-woolled mutton sheep are not highly esteemed. They produce less wool than the Merino; consume more food; are unsuited by nature to congregating in large flocks, and do not live as long as the Spanish Merino. With novices in breeding, the size of the Spanish sheep is against them, and it is a prevalent opinion that their flesh for the table has no value. I have held that grass-fed grade Merino mutton is far inferior to that of the coarse-woolled sheep; but that when fed on corn through the winter the "sheep taste" is gone, and the meat is delicious. Mr. Randall, in his report referred to, makes this strong case for my favorites:

> "The meat of the Merino, when well fattened and properly treated, (not cooked and eaten too soon after being killed,) is juicy, short-grained, high colored, and well flavored. Though the scarcity and value of full blood Merinos have prevented many of them from appearing in our markets, the grades have always been favorites with the butcher and consumer. The former finds that they weigh well for their apparent size, and get to market in excellent condition. There is not a drove that sweeps from the plains of the northwest that does not exhibit a sprinkling of this blood; and if they are merely grass-fed, the twenty fattest and least travel-worn sheep in the drove will usually be found those which, by a little darker tinge of their wool and its greater thickness and 'squareness on the ends,' betray more Merino blood."

The French Merinos have lost their popularity, being a sheep with less constitution than the Spanish, and only producing a great growth of wool when kept in high condition. Yet some of the heaviest shearing flocks within my knowledge are French stock crossed by the use of Spanish bucks.

A. B. McConnell, esq., of Illinois, one of the largest and most successful flock-masters in the country, has shown me fine products of this cross, and these are his published opinions:

"Both (French and Spanish) have their admirers, and I suppose that circumstances and locality will govern to a great extent, without deciding between them. In central Illinois and south where they can be herded on grass the most of the year, and corn is grown cheap and in great abundance at a low price, I think the French will always prove the most profitable. * * * The wethers make good mutton, will fatten readily in large flocks, and will fall but little behind the mutton sheep in weight, and when the wool and mutton are taken into account they will prove a profitable breed for the farmer."

The *Silesian Merinos* have of late been brought into competition with French and Spanish stock. It is claimed that they are pure Spanish sheep. Louis Fischer, of Silesia, has their pedigree running back to 1811, and claims them as the best Infantado ewes crossed with Negretti bucks. They are not as large as our American Merinos, nor as dark-colored on the surface. The wool is oily, but free from gum, and does not on the surface stick together.

Mr. William H. Ladd, of Richmond, Jefferson county, Ohio, one of the most liberal and intelligent breeders of stock in our country, is an advocate of the Silesian. In a letter before me he says: "That by judicious classification, numbering, and selection, for fifty-two years without any outside cross, they have obtained an identity of characteristics never reached in a large flock before." He adds: "That having bred these sheep now a number of years, I consider them to have good constitutions. Owing to their great purity of blood and fixedness of characteristics, they possess the power of transmitting their qualities to a remarkable degree, when crossed upon the other fine-woolled sheep of the country. I have sold ewes to be crossed upon almost all classes of fine-woolled sheep, and never knew them fail to increase the weight of fleece by adding to the density."

Mr. Sanford Howard, of the "Boston Cultivator," who witnessed the shearing of Mr. Ladd's Silesians, some years since, made these observations at the time:

"The sheep appear to excel in the following points: In the thickness of the wool as it stands on the skin, growing to an unusual extent on the belly, and covering every part, giving an uncommon weight of fleece in proportion to the size of the carcase; in the fineness of staple, considered in reference to the weight of fleece; in the uniform character of the fleece, the wool on the belly and thighs approximating, in a remarkable degree, to the quality of that on the back; in the fullness, evenness, and elasticity of staple."

He adds:

"The sheep are well shaped; * * * the body pleasing and symmetrical to the eye. The different individuals, also, bear a close resemblance to each other. They appear to have good constitutions."

W. R. Sanford, esq., of Vermont, in his published notes of an European tour, in 1851, on visiting the famed Silesian flock, admits his partiality in this language:

"They have more good points than any sheep I have ever met with before. They are clothed in wool from the nose to the hoof; it is thickly set and of an even surface—a perfect wool staple. * * * They will shear as much, according to weight of carcase, I am sure, as any sheep I ever saw. It is quite fine for Merinos, clear and white on the inside, but quite dark on the outer ends."

So much of testimony may be due to a class little known, but having ardent admirers, while my favorites for the prairies—the Spanish stock wherever bred—"speak for themselves;" and I come now to

PRACTICAL MANAGEMENT.

On the "old farm" it is easy for the son to do what his father has done for years before him successfully; but in a new country, with a numerous flock,

and without practical experience, he is likely to follow the unskilled, and meet the losses and derision, represented in the homely figure of "coming out at the little end of the horn."

Men advanced in years, who have made the flock a life-study, have, according to their own convictions, passed but to the threshold of inquiry; but they have given us of to-day a noble vantage ground, with the strong reflections of light from their failures, successes, and philosophy. They have so far established sheep-breeding as a science as to bring the eminent flock-masters of the Old World into the company of princes and the learned; and the pioneer shepherds of our own country, embracing Livingston, Humphreys, Jarvis, and others, by their devotion to sheep, *the* animal, have eclipsed their valuable civil and diplomatic service. Being too benevolent to "put their light under a bushel," and telling plainly to eager learners what they knew, they have caused their names to be gratefully apostrophized to-day in the homes where the flock has a friend, and more intelligently revered than was Pan in heathen mythology by the shepherds on the plains of the east. Theirs and the later experience is, that "blood tells," and that good stock from the *best families* is desirable, yet not essential to success, since it is as easy by good management to be possessed of a good flock as it is of a fortune. Full-bloods were not always within the reach of those who have established a good flock. Fortunate in procuring bucks of pure blood, they were used, and the best of their stock was crossed to remedy defects, and the more perfect models again used until, in many cases, the crosses have, in beauty, constitution, and product of wool, surpassed those of noble pedigree. I observe now in Vermont flocks but faint evidences of the Saxon blood, which, but a few years ago, predominated, causing the flocks to be well near worthless. Eminent French writers declare that however coarse the fleece of the present ewe may have been, the progeny in the fourth generation will not show it. In a few generations the best staple found may be obtained even from our native stock of ewes; and if, as is said to be true, there is no difference now made in Europe in the choice of a buck, whether he is full blood or *fifteen-sixteenths*, we may be less mortified by the impositions to which we are subjected, having bought stock showing well, yet of doubtful blood.

It is fatal to success to overstock and allow the flock to sink into the extreme of poverty. This is attended with a loss of wool and the degeneracy of the increase. The other extreme is a forced, unnatural growth, by too high keeping, that produces a weakness which is stamped upon the offspring, and becomes the occasion of discouragement to the sanguine purchaser of stock, who must see his "bloods" go down, or prepare for them every delicate attention and prevention against cold and storm, as if the nurse of old age, infirmity, or childhood's weakness. The old Greek maxim for the boy was, "become that which you would wish to appear;" and it is a departure from the principles of common honesty for the breeder to show animals for sale which are pampered, and will lose their attractive appearance when subjected to common yet proper treatment.

Let the flock be well prepared for winter. The early frosts will destroy our native grass, and then oats in the sheaf may be fed, and the stubble-land may be pastured, but to make it certain that the fat taken on in the summer is kept there at the latest day possible, timothy grass should be laid down, and be reserved for the flock until the prairie grass is frosted. Rye, too, may be sown as a substitute for grass. For lambs, it is most admirably adapted. It may be sown among the corn, and on the approach of winter it will be found that the lambs have learned by degrees to eat the corn and to have attained an astonishing growth at late autumn.

Winter being upon us by the first of December, this is the time for sorting. Lambs should always be folded separate. Yearlings having weak teeth should,

if there is a flock of over one hundred, be fed by themselves. Large wethers should be sorted out from the ewes, and the breeding-ewes put in a pen of such dimensions, with gates, that they may be handled with ease, and when in season, served with promptness and marked, that the time of their lambing may be known, and the sire of their offspring. Once in two weeks the teasers may be turned in, to find such as have escaped impregnation. It is never a good practice to let the buck run at large with the ewes, but where there are not more than thirty or forty ewes, after the first week, it will do. I depend on a full-grown buck for from fifty to one hundred ewes.

Every good shepherd will have a hospital flock, on which he will bestow extra attention, and to which he will add from time to time such as are drooping, or are pushed aside from their grain, or are doing poorly from any cause.

Sheds which will keep out the wind and rain are essential. When boards are not to be had, poles and a good covering of straw will be a substitute for one or two winters. I am not partial to close confinement in tight sheds, except it is a necessity to keep the flocks from wolves or dogs, or to keep the ewes from exposure in lambing time. Let the sheds be low and open on the south side, and if the extreme cold for a long period pinches and impoverishes the flock, increase the feed of grain and you restore the warmth and arrest the decline. Cold is favorable to a good growth of wool, but to economize food and insure the health of the flock the more even the temperature the better.

A good feeder will have hay-boxes and grain-troughs. The flocks may *live* if fed on the ground, but nothing less than keen hunger will force so delicate an animal to take its food from the wet and filth of the yard. The racks will more than pay their cost by a saving of hay in one winter, and if grain not in the sheaf or ear is fed for more than one-half the season, troughs will be an imperative necessity.

It is a part of good management to indulge the epicurean tastes of the flock. Why should the sheep be confined to the same variety of food from month to month, a treatment which we would deem a hardship? Every pioneer farmer can cut prairie grass, which is a suitable, well-relished food, and Hungarian hay cut early is very nutritious; then he may make up a variety by feeding oats in the sheaf, timothy hay, and corn cut before frosts and fed in the bulk. Many well-wintered flocks have subsisted on cut-up corn mainly, which has increased the weight of the fleece above that attained by ordinary keeping full 20 per cent. There is no excuse for having poor stock, if they are fed three times a day, and furnished with salt and good water and such varieties of food as our country readily furnishes.

So soon as the snow has passed off in the spring, there is a strong temptation to let the flock out on the ground and effect a saving of expense in feeding. This is a ruinous practice. Fasting becomes a necessity, if there is not grass, and the flock is returned to dry hay, wasted in flesh, and with a loss of appetite, when the breeding ewes especially should have received extra attentions by a daily feeding of roots or bran, that there might be an abundance of milk for the lambs.

If the lambing season does not begin before there is a good bite of grass, the shepherd will be spared much of vexatious care, but under the most favorable circumstances it will be found the poorest economy to forego personal attentions for a single day. Occasionally a ewe will sink under the labor of parturition, and must be relieved. Often the best sheep will refuse to let the lamb suck because of the distention and inflammation of the udder, and for several days the milk must be drawn away by hand. In the case of abortions, malformations and the birth of twins or the loss of a mother, there will be found enough of nursing and mating to give a profitable employment.

Tagging, which is not so necessary as at the east, owing to the astringent nature of our prairie grasses, may be done early to prevent the gathering of

filth on the most exposed parts of the wool. It is also a good practice to shear the wool and sweat-locks from the udder and vicinity, that the young lamb may readily find the teat.

I forbear to speak of the best *washing methods*, being opposed to the practice as one injurious to the sheep—often detrimental to the health of the washer—presenting a temptation to half do what ought to be well done if at all; and so varied is the time between washing and shearing allowed by different owners, and such is the apparent unconcern of the wool-purchaser whether the flock just from the stream was herded on the sod or the sand, that I am persuaded the honor and interest of both the producer and purchaser of wools would be subserved by a public sentiment which inhibits the practice of sheep-washing altogether. If the wool-buyers would make only a deduction of 20 per cent. on the unwashed fleece, which, I think, would be reasonable, I should never wash another flock.

To *shearing and folding* we attach importance. Boys can do the shearing. It is not common for a man advanced even to middle life to take up the business successfully. The learner must be patient, and content to clip a small amount of wool for the first few days. Neither violence nor a great amount of strength will be required if the sheep is kept "on end," and practice will soon show that the position is the natural one, preventing successful struggles on the part of the sheep, and the only sure protection against torn fleeces. The barn floor, in preparation for shearing, should be as clean as the house floor, and a platform made of planed plank, should set about eighteen inches high, so that the neck of the sheep may rest on the thigh of the shearer, having one foot on the platform. Sheep, to shear well, must have a full stomach, and have a good covering of flesh on their bones. It is no object to take the last ounce of wool, for in the process clips of hide are usually taken, and the animal is exposed to being sunburnt, and will more readily take cold on exposure.

A second platform, built as high as the waist of the folder is necessary, and this should be smooth, that the wool may be put up neatly and in compact form, exposing the shoulder, the best part of the fleece, "of course." I prefer a folding box on which the twine is laid; by bringing up the sides and ends fastened by hinges, you have compressed fleeces of uniform shape.

It is quite time that there was a uniform practice of storing our wool at home, or in a neat place prepared for the neighborhood, rather than to pack it off through dust for a street show, and when in the hands of the purchasers, left to their combinations and the daily fancy quotations of the market. Prairie wool has a dark color, given to it by the soil and burnt sod, but this does not detract from its value; and if it is a long staple, grown on a healthy sheep, yielding to the touch and corky, it has a real value which will bring eager purchasers the distance of a long journey.

Good summer treatment will consist in furnishing ample pasturage, by allowing the flock in the open country a feeding circuit of miles, that they may cull the choicest blades in valley and on hill-top, permitting them to slake their thirst at pleasure, and choose the hours and time when they will rest in the shade. The yard for folding should be on the side of a hill that an accumulation of wet and filth may be avoided, and when the flock is large there should be a change of yard at least once a week. If the pastures are enclosed, it will be found conducive to health to change the flock as often as twice each month. My rule in salting is to feed not less than four quarts a week to a flock of one hundred head.

Lambs should be weaned at the age of four months. When passing through this severe trial it is best to put them on a fresh pasture, and so far removed from the dams that their bleating cannot be heard, and they will soon become quiet and thrive well. In every large flock there will be those which are small and weak. Often the very best bloods may prove poor nurses; but if

with early attention, in addition to fresh feed, a daily allowance of bran or oats is furnished, all may be wintered.

I have but glanced at these topics, which are the "head-lands" of the subject; and many important matters in the details of sheep husbandry I must leave unnoticed to abbreviate this article, adding little more than my personal experience as an admirer of the sheep and the owner of a flock, which I shall call a foot-note.

I well remember, when a boy on a Vermont farm, thirty years ago, the blooded lambs of Judge Hoyt, who had, it was said, a buck right from Spain and ewes from the flock of "Consul Jarvis," I remember that they were unlike other sheep in that region of Vermont, which were mostly natives, and in contrast, low, thick-set, with very white faces, while the surface of the wool was of a dark color and a gummy appearance.

Saxony sheep were soon brought on to the farm, being all the rage at that day. Their wool was of remarkable fineness, and I remember the boast of their great admirer (a wool-buyer) that one of the stock clipped *three pounds*, and it was worth *sixty cents* a pound. Flocks were crossed seemingly without regard to any other quality than a fine staple, and the "silk-worms" were introduced, capping the climax of fineness, as they truly did of folly. These were so tender that to save the lamb it became the rule to dip it in a pail of tepid water, and it was only by having almost air-tight barns, and giving the closest attention, that the lambs passed through the first winter. Fine wool was presently in less demand, and the sheep-raisers in that region of the country who had been able to do it discovered that they had a flock with a light fleece and feeble constitution.

Being weary of nursing those exotics by night and by day, I stealthily but most conscientiously inducted a buck into the yard—a cross of one of the early Merinos. This sheep was deemed as "coarse as dog's hair," with the declaration that not one of his lambs should be nursed by those Saxony ewes; but the lambs survived the threat, and I was their feeder the first winter, and strove to make good the cross by the best attentions which I could bestow. At shearing, their clip was five pounds six ounces each of clean-washed wool—a wonder of the day, which found its way into the papers, creating a demand the same season at good prices for all the bucks of that cross. I remember that as one of the proudest days of my life, when ex-Governor Chittenden, of Vermont, alighted from his carriage, and asked me, "Will you sell me one of those good shearing bucks?" As a boy, I regarded it as a compliment, and it stimulated me to maintain my little reputation as a breeder and feeder.

Those days were followed by two seasons of most painful experience with the foot-rot, in a flock of several hundred, one-half of which much of the time, when in pasture, would eat on their knees, and each week their hoofs must be pared and vitriol applied.

The near approach of winter found the flocks diseased, so poor that hundreds were pelted for the wool, and the business was for a time divested of its romance by this most loathsome disease, which, happily, is unknown, or will not abide with flocks herded on the prairies.

From this period up to the last six years, I did not lose my interest in the flock, although but a theorist and an observer on various farms and at State and county fairs.

My practice was renewed six years ago, on the purchase of 100 good ewes, of about three-fourths Merino stock, from a reputable breeder in the State of Michigan. Many of this original stock are yet on my farm, good shearers and breeders.

Three years later, I purchased a few hundred more of similar stock, and two years ago a larger number; a year ago, a few hundred of superior breeds, costing from six to fifteen dollars each, making my total flock purchased and raised about 4,000 head.

The average clip of the flocks, with fair keeping, is, of washed wool, about four pounds each. I do not claim a large number of bloods, but those I own have quite met my expectations. From the flock of Lyman Wood, residing in Lodi, Michigan, I purchased twenty Spanish lambs, which gave at their first shearing *eleven pounds* each. A company of Vermont lambs, of the same stock, numbering thirty, from the flock of the late Dr. Eels, of Cornwall, Vermont, sheared twelve pounds each, without pampering or any extra attention. Great success I do not claim; but have demonstrated that native prairie grass, up to the time of frost, as a pasture, and when cut early for hay, is quite equal, (if embracing weeds of resinous qualities, and what is known as "blue joint" grass) to the timothy hay of the eastern meadows. It is proven, too, that the northwest furnishes a healthy home for the flock; and, further, that a removal of the sheep to the prairies, from the east, greatly increases their size; also, that an allowance of corn to the amount of three bushels to each sheep, is both a safe and cheap food, and will add to the product of wool above that gained from common feeding not less than twenty per cent. I estimate the enhanced value of virgin prairie, when well pastured, to be equal to the government price. The native grass is killed, hence the expense of ploughing is lessened, and the soil is ready for a good crop the first season.

Another material fact, which may allay the fears of the young shepherd, is, that it is not common for the sheep to die in your debt. Your valuable horse, worth, perhaps, fifty sheep, on its death is a total loss; and from the ox or cow dying by disease, accident, or poverty, you may not save more than ten per cent. of its cost; while from the sheep, at death, it is usual to obtain from fifty to seventy-five per cent. of its value in wool.

I have purposely avoided the minutiæ of fine breeding, confident that for the present we can well forego the purchase of fancy stock, while those who have small flocks from necessity, and almost perfect apartments for winter keeping, will want us for customers a little longer. Without disparaging the favorites of any breeder, I will only say, I have tried mutton sheep. My first purchase of Cotswold crossed on the Merino resulted in a failure. A Leicester buck I have used to grade Merinos, and shall do so no more. South Downs I find hearty, early maturing sheep, of beautiful form, but very light shearers. My last full-blood ewe of the Downs died from eating too much corn, picked up in the stalk-field, and I bid adieu to coarse fancy sheep. That they have their uses, when kept in small flocks and near the cities, I will admit, but they are ill-suited to make up a large flock, and are unprofitable when wool is the prime object.

Sheep driven into this country with the foot-rot, I have observed, recover from this disease without attention; and not knowing of its existence in any flock in the State, I am of the opinion that it will not abide with us.

I have seen what is known as the scab but in one flock. There is a species of mange, or itch, which results from keeping a large number together in filthy apartments, and a want of good air. Some of my flocks have it. In addition to being a great trouble, it will, if neglected, result in a loss of wool, and in a confirmed contagious disease.

It first shows itself by violent scratching with the hind feet, and presently small yellow or purple spots will be noticed on the skin, which soon becomes bare and sore. Every sheep affected should at once be sorted out from the main flock, and dipped in a strong decoction of tobacco juice, in which vitriol, in the proportion of one ounce of vitriol to one pound of tobacco, may be added. Two or three applications of this liquid, at intervals of a few weeks, will effect a certain cure. A mixture of sulphur and lard is applied with good success.

I have a few cases of "stretches" in the flock each winter. It is evinced by loss of appetite, and almost continued stretching. I think it occasioned by

dry food, which brings on constipation. A dose of oil, with a small admixture of turpentine, I have found to work a cure. Forcing the sheep to swallow a small quid of tobacco is said to be a safe and effective remedy.

Swelling in the throat is a late affliction which has resulted in some sections of Michigan and New York in the loss of from twenty to fifty per cent. of the young lambs. This disease has caused me the loss of a few valuable lambs, and occasioned serious apprehensions on the part of many sheep-owners.

The lambs are often weak at birth, yet by feeding, their lives may be prolonged, until the lumps in the throat become so large that respiration is no longer possible. It is an affection of the thyroid glands, and, from the early death of the lambs, it must be congenital. The disease is named clyers. My friend, William M. Holmes, esq., of Union Village, New York, who is a good breeder and a close observer, is of the opinion that the ammonia in exhalations from filthy yards and close sheds is promotive of this modern disease. It may be scrofula, which will prove to be connected with certain classes of animals inheriting impure blood, as it is with families of the human race.

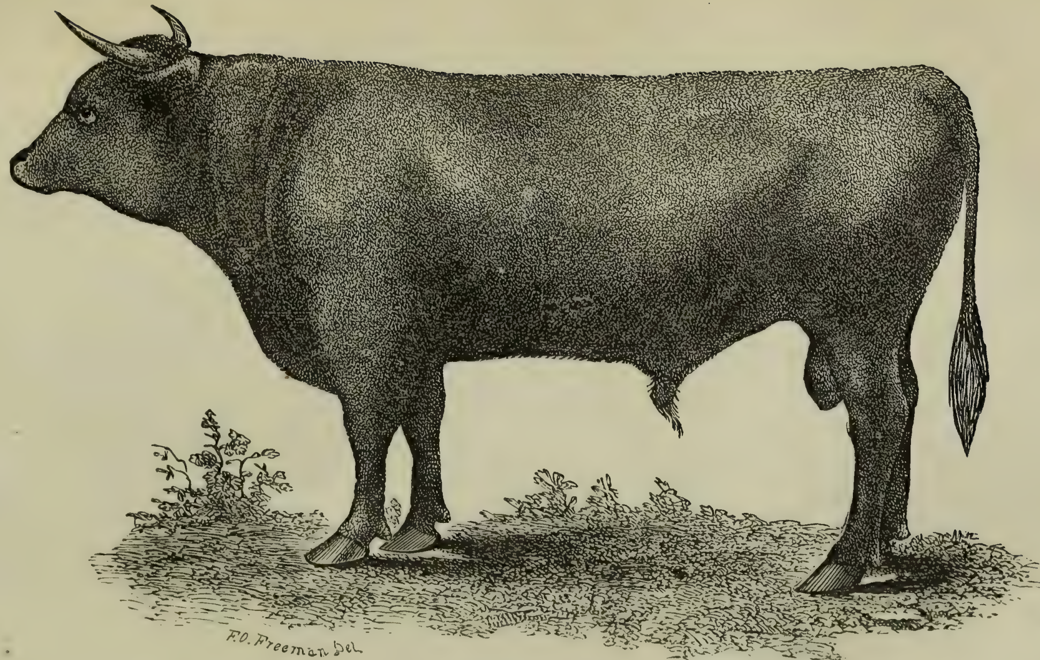
Drawing this article to a close, in which I have striven to condense the practical rather than to elaborate my thoughts, I give it as the sum of my conclusions, that the patient, intelligent wool-grower on our new lands will find no obstacles which may not be readily overcome. Present success gives the promise of such an extension of sheep husbandry that in a few years we shall not be under the necessity of importing, as now, thirty or fifty millions of pounds of wool to clothe our population. Good breeding has added, in the northern section of the Union, twenty per cent. to the weight of our fleeces during the last ten years, and the next decade promises a larger increase.

Our national sheepwalks, as yet untrod by the "golden hoofs," embrace an area of country larger than the pastures of ancient Assyria and the famed pastures of Europe; and had we a population one-half as dense as that of the sheep districts of France and Spain, without lessening the other staple products sent to market, we could clothe our own people, and produce a sufficiency of wool at forty cents a pound to pay the interest and principal on our debt of one thousand millions of dollars within the period of time which has been required to earn the well-deserved fame of our American Merinos.

The poetic aspirations of Colonel Humphreys, written more than a half century since, while abroad, will represent the desire of men who, in the decline of life, have left public stations, not more than the ambitious lovers of the flock in the west.

> "Oh! might my guidance from the downs of Spain
> Lead a white flock across the western main,
> Famed like the bark that bore the Argonaut
> Should be the vessel with rich burden fraught.
> Clad in the raiment my Merinos yield,
> Like Cincinnatus, fed from my own field,
> Far from ambition, grandeur, care, and strife,
> In sweet fruition of domestic life,
> There would I pass, with friends, beneath my trees,
> What rests from public life, in lettered ease."

Since there is no picture of varied rural beauty drawn on canvas without the presence of the flock, I entertain the hope that there may soon be transferred a *life scene* to every prairie farm where is seen the prospered shepherd, and happy children witnessing the sportive glee of the lambs. Not long, then, shall we wait to hear the hum of machinery in the fabricating of our wool by our waterfalls, and the presence of refined and advancing civilization.



Kerry Bull, "MOUNTAINEER" *Imported by*
Arthur W. Austin, Esq., West Roxbury, Mass., 1860.

PHOTOGRAPHED BY COLE.

THE KERRY BREED OF CATTLE.

BY SANFORD HOWARD

THE Kerry cattle having been lately introduced into this country, the agricultural public may be interested in a few remarks in regard to their history, characteristics, &c.

The attention of the writer of this article was first particularly drawn to these cattle by reading Professor Low's description of them, accompanied by a beautiful colored engraving of a cow of the breed, in his illustrated work on the "Domestic Animals of Great Britain." A portion of this description is as follows:

"The native breeds of Irish cattle may be divided into those of the mountains, moors and bogs, and those of the richer plains, with intermixed breeds resulting from the union of different races, foreign or native. The mountain breeds approach to the character of the ancient White Forest breed in a sufficiently near degree to indicate a common descent with the cattle of the mountains of Scotland and Wales, and the highlands of Devon.

"Of the native breeds of Ireland, one very peculiar and well defined is derived from the mountains of Kerry, the most westerly land in Europe, and remarkable for the humidity of its climate. * * * They are of various colors, as black, brown, and mixed black and white, or black and brown. Their horns are fine, long, and turned upward at the points. Their skins are soft and unctuous, and of a fine orange tone, which is visible about the eyes, the ears, and muzzle. Their eyes are lively and bright, and although their size is diminutive, their shape is good.

"These cattle are hardy and capable of subsisting on scanty fare. Although stunted in size when brought from the bogs and sterile pastures on which they are reared, they make a wonderful advance in size, even though several years old, when supplied with suitable food. The fat of their beef is well mixed with the muscular parts, or, in technical language, *marbled*, and they fatten well in the inside.

"But the peculiar value of the Kerry breed is the adaptation of the females to the purposes of the dairy. In milking properties the Kerry cow, taking size into account, is equal or superior to any in the British islands. It is the large quantity of milk yielded by an animal so small which renders the Kerry cow so generally valued by the cottagers and smaller tenants of Ireland. She is frequently termed the poor man's cow, and she merits this appellation by her capacity of subsisting on such fare as he has the means to supply."

The descriptions given of the breed by other writers do not differ materially from that of Professor Low. Youatt says the Kerry is "emphatically the poor man's cow: hardy, living everywhere, yielding for her size abundance of milk of good quality." Milburn says "she is a treasure to the cottage farmer; so hardy that she will live where other cattle starve. She is a perfect machine for converting the coarsest cattle food into rich and nutritious milk and butter."

These and other accounts of the Kerry cattle I read many years before the opportunity was presented me of seeing any specimens of the breed. It seemed to me that if the qualities of the cattle had been truthfully stated, the breed would be valuable in this country, to some extent. On visiting Europe in 1858 I made a tour of several hundred miles mainly for the purpose of seeing the Kerry cattle in their native country, and studying their characteristics as there developed.

I may here remark that erroneous ideas prevail, more or less, in regard to the true type of the Kerry breed. From the fact that the long-horned breed is kept in the lower and more fertile parts of the county of Kerry, some people appear to have taken them for the real Kerries. The long-horns are the native race of the island alluded to by Professor Low as belonging to the "richer

plains." They correspond in general character to the long-horns of England. They present a striking contrast with the Kerries, or cattle of the mountains, being, comparatively, of large size, with long, drooping horns, which sometimes cross each other beneath the lower jaw. The Kerries, on the other hand, are small, with horns of medium length, rising and generally somewhat spreading.

On arriving at the town of Killarney I made inquiries in regard to the localities where the Kerry cattle were bred in their greatest purity, and ascertained that the mountainous section of the southwest quarter of the island was the principal territory for them. Obtaining a guide who could speak both the English and Celtic languages, and a sure-footed mountain pony, I commenced observations. I found the cattle somewhat smaller, and occupying a wilder and more forbidding territory than I expected. At elevations of two thousand feet or more above the sea I found them sharing with the goat the natural vegetation of the mountain's side. The region presents no cultivation except a few patches in the valleys of small streams. Still the cows appeared to yield a good quantity of milk, which produces a very fine quality of butter. I was convinced that I had never seen any other cows which could sustain themselves so well under such circumstances. I was not a little surprised to learn that the cattle, with the exception of the cows in milk, remained on these bleak pastures through the winter season. Yet their inherent hardiness enables them to go through this apparent hardship probably without much suffering. They are clad in a very heavy coat of hair, thick and furry next the skin, rendering their bodies almost impervious to wet from snow or rain. As illustrating their hardiness the following incident may be related: A man led me up a mountain glen to see a lot of three-year-old heifers he had grazing there. It appeared surprising to me that the cattle could obtain a subsistence even in summer among the rough rocks with which the side of the mountain was nearly covered. Having noticed that the man had several stacks of hay down in the valley where was the rude habitation which he called his home, I asked him if he was going to take these cattle there for the winter. He replied, "No; the hay is for the lowland cattle and ponies." He had just been telling of the deep snows which sometimes fall in the mountains, and I asked what the cattle would do in such cases? He said, "Oh! the snow generally softens after a day or two, and the cattle can work through it."

I had also the opportunity of seeing some specimens of the Kerry breed on lowland farms, but none that had been kept in such situations long enough to show fully the effects which better food and better climate would have on them. To ascertain this it would be necessary to breed the animals, perhaps for more than one generation, in the localities most favorable to their development. In the park of Lord Kenmure, at Killarney, I saw some very pretty Kerries, and was particularly struck by the contrast presented between a small Kerry bull and a very large short-horn, grazing quietly together and apparently much attached to each other. As to shape, both were good representatives of their respective breeds, but the Kerry was smaller and the short-horn larger than the average. Both appeared to be about full grown, but the back of the Kerry was only on a line with the stifle joint of the short-horn when they stood side by side. I also saw cows of various ages at other situations in the same neighborhood, and was assured by their owners or persons having charge of them, that they gave in the best of the season from ten to twelve imperial quarts of milk each per day, and that seven pounds of butter from each cow per week was often obtained. A statement given by Youatt in regard to the production of cows kept by Mr. Crosby, of Ardfert Abbey, near Tralee, Ireland, is worthy of notice. For a period of seven years in succession, the dairy comprised from twenty-eight to eighty cows, mostly Kerries, and they gave on an average 1,952 quarts of milk each, per year, which yielded a pound of butter to eight quarts or 244 pounds

per cow annually. One pure Kerry in the herd gave 2,725 quarts of milk in ten months.

For various reasons, which it is unnecessary to mention in this connexion, I did not at this time purchase any Kerry cattle; but in 1859 I again visited the same section, when I extended my examinations still further, and purchased for Arthur W. Austin, esq., of West Roxbury, Massachusetts, a three-year-old bull and five two-year-old heifers of the truest type of the Kerry breed. They arrived here in the month of November after a very long and boisterous voyage, which greatly reduced their strength. The bull was so completely exhausted that he died in a short time after his arrival. Another bull and two heifers were immediately ordered, which arrived here early in July, 1860.

The heifers first imported produced their first calves in May, 1861. All proved remarkably well, except one designated No. 3, which, after having produced a very fine calf, and giving for several days from twelve to fourteen quarts of milk a day, suddenly died. The heifers of the second importation calved in July and August, 1861. In regard to their product for the first year the following extract from a statement submitted by Mr. Austin in connexion with the exhibition of some of his cattle at the show of the Norfolk Agricultural Society, 1861, may be taken. He says:

"I often had the milk measured during the past summer, and found it did not go below sixty quarts a day for five heifers of the first importation. On the 31st of May the five alluded to having, in that month, produced their first calves, gave 60½ quarts, or an average of 12 quarts each. On the 14th of June the same five gave 62¾ quarts. Three of them gave a fraction over 14 quarts each. I weighed the morning's milk, and the 31¾ quarts, wine measure, weighed 67½ pounds. Of the two last imported heifers, one is fully equal to either of those of the first importation in proportion to age, she being a year younger, and having given, with her first calf, over 10 quarts per day during the summer. The milk of all of them is of the first quality as to richness. Butter is obtained from the cream in a very short time. Late in October it required less than five minutes' churning, by the clock, to bring the butter. A lady who sends for six quarts once a week, and who has had much experience, pronounces the production of cream marvellous. She says she skims it several times over. I have had excellent milkers of different breeds, and have always been particular as to *quality* more than *quantity;* but I obtain from these Kerry heifers as large a quantity of milk as could reasonably be expected, considering their size and age, and the quality certainly surpasses, on the average, any milk it has been my fortune to see."

The same animals produced their second calves in May and June, 1862. In regard to their returns for the present year, Mr. Austin states that five of them gave, by actual measurement, from twelve to sixteen quarts of milk (wine measure) per day in July last, two of them coming fully up to the maximum quantity, and two others reaching fourteen quarts each. The stock of this breed now in Mr. Austin's hands, and which comprise all of the genuine Kerries I have ever known in this country, are a bull and six cows, imported in 1859 and 1860, four males and three females produced in 1861, and four males and two females produced in 1862—making, in the aggregate, twenty head of full-bloods. It may be stated, however, that Mr. Austin has lately disposed of several of the yearlings, though they have not yet been taken away. Several crosses have been made with the imported Kerry bull, (Mountaineer,) but none of the stock have yet arrived at an age to show their qualities for the dairy. They are thrifty, and have good points, the remarkable symmetry of the sire being transmitted to them in a striking degree.

The points of the Kerry cattle may be briefly stated as follows: The head rather short, with face somewhat dished; the forehead broad, the muzzle rather wide, with a spreading nostril; the eye large and lively, but mild in expression; horns rather long, of good proportions as to diameter, and generally turned upward and outward; the neck small at its junction with the head, but pretty full and deep at its junction with the body; the shoulders rather sloping, fine at the points, and joining smoothly with the body in all places; the back straight; the chine and crops full; the loin wide, and the rump long; the

chest generally deep and capacious; the flank full and deep, and the muscles of the hind quarter well developed, though the thighs are thin; the udders of the cows are wide and square, rather than deep and pendant; the teats of medium size, and placed widely apart; the legs short, and the shank bones fine; general appearance spirited, and movement quick and easy. As to color, black prevails, and it is preferred in Ireland as indicating the nearest affinity with the original type; but brown, brindled, and red frequently occur. All those which I obtained are black, and all their offspring are of the same color except one, which is brown. One or two have a white spot in the forehead, and several have white about the udder. The skin is thick, mellow, and elastic.

Mr. Austin's cattle already exhibit some changes, which are worthy of note. The most obvious is increase of size. The keeping they have had is fair pasture in summer and good hay in winter. Their growth for the first year was very rapid. When I bought the first five two-year-old heifers, their girth was only four feet five inches to four feet six inches. I measured two of them a few days since, and found their girth five feet seven and five feet six inches, although, from having been pretty well *milked down* during the season, they are in only middling condition. The stock born and reared here are larger, at a year and a half old, than the imported stock was at two and a half years old.

Another striking change which they exhibit is in attaining the state of puberty. Among their native mountains, the heifers seldom evince any inclination to take the bull till they are three years old, and I was assured that it is the general custom to put them to the bull in the month of September after they are three years old. The five first imported did not come in heat till July, 1860, when they were over three years old, notwithstanding they had plenty of grass and hay after their arrival here, and were in good order. Nature evidently adapts animals to circumstances. If these cattle were to produce calves in their native country at as early a period as it is common for cows to do where they are placed in favorable circumstances, the breed would inevitably deteriorate; but by their not breeding till they have nearly reached maturity, their strength and hardihood, so indispensable to the condition in which they live, are maintained. But, mark how soon an improvement of condition affects the system! Two of the heifers reared here took the bull when but a little over one year old. It may, however, be remarked that they are about as large as heifers of the common stock of the country usually are at that age.

Mr. Austin's mode of rearing the calves has been to allow them milk, which they are taught to drink, when two or three days old, till they are ten to twelve weeks old, gradually diminishing the quantity for the last two weeks of the time. They are then weaned and turned to grass. Last spring the Kerry yearling heifers and several cross-breds were turned into a forest range, where patches of grass and bushes alternated with trees. They remained here several months, the full-blood Kerries sustaining themselves well, and evidently doing better than the others. The stock has a very thrifty habit, and tends to fatten easily. The quotation from Low shows in what estimation their beef is held. It is universally admitted to be of the best quality. Butchers who have looked at Mr. Austin's Kerries say that they will make more weight of high-priced beef than the common or "native" stock, the tendency being to make very thick back-pieces.

The purchase of these cattle in Ireland to come to America attracted considerable attention. The fact was noticed in several newspapers, and while the cattle were in Liverpool many persons called to see them. Singular as it may seem, but few people in England had ever seen a specimen of the breed. How much this purchase has had to do in bringing the Kerries into general

Kerry Cow, "PRIMA" *Imported by*
Arthur W. Austin, Esq., West Roxbury, Massachusetts, November, 1859.
(PHOTOGRAPHED BY COLE.)

notice I cannot say; but it is certain that attention has, within a year or two, been more turned to them than ever before. English papers state that Baron Rothschild has sent a large number to his Australian possessions, the first lot of fifty heifers having been shipped a little more than a year ago. They are also attracting much more attention in England, as is shown by the special prizes offered for them by the Royal Agricultural Society, and the favorable comments made on those exhibited at its shows. As to their adaptation to this country, I think there is good reason to believe that in some situations their substitution for the stock now kept would be a decided advantage. Such situations are hilly and mountainous districts, and the rough, poor, bush pastures of this section.

Hon. John Wentworth, of Chicago, Illinois, well known as a large stock-breeder, saw Mr. Austin's cattle last summer, and in writing to the "Prairie Farmer" in regard to them said: "Whilst I will say that they are exactly the breed of cattle for the mountainous pastures of New England, I will also say that if I lived out on the open prairie, had no barn, and could keep but one cow, I would prefer a little black Kerry to all others."

I will only add, in conclusion, that the success which has thus far attended these cattle in this country, is fully equal to what had been anticipated, and offers every encouragement for their further introduction and trial.

ON STALL-FEEDING CATTLE AND SHEEP.

BY JOSEPH HARRIS, ROCHESTER, NEW YORK.

THIS subject is not one of my own selection: I have been asked by an esteemed friend to make a few remarks upon it for this number of the Agricultural Report. If anything I can say shall induce farmers more generally to practice stall-feeding, I shall esteem it a high honor.

It is a matter of surprise to all intelligent persons familiar with the facts, that so many cattle and sheep are sent to market in a half-fatted condition. Nothing can be more unwise—nothing more unprofitable. Large fortunes have been made by farmers living in the eastern counties of this State by purchasing half-fat cattle that had been sent from the west to the New York market at low rates, and after keeping them for a few months, until fat, selling them at good prices. Now, it would seem to be far better for all farmers of the west to fatten their cattle where corn is cheap, than to sell them in a lean condition. If it will pay the farmers in this State to purchase such animals for the purpose of fattening, then it certainly would pay the farmers in the west to make them fat before sending them to market. The cost of sending a fat animal from Chicago to New York is but little more than the cost of sending one that is only half-fat, while the one will bring nearly as much again as the other.

The farmers of the west, however, are improving in this respect. Better cattle are not only being rapidly introduced, but some attention is paid to fattening them; and it is becoming a serious question with the farmers of the eastern and middle States, how far they can compete with the west in producing beef, pork, mutton, and wool. The freight on a hundred dollars' worth of these articles is far less than on a hundred dollars' worth of grain, and the

tendency of such a state of things is to force all farmers of the east to turn their attention more to the production of grain, and leave the production of meat and wool to their brethren of the west. The high rates of freight on grain enables us successfully to compete with the west in the production of wheat and other grains; but as the freight, in *proportion to value*, is far less on beef, pork, &c., the competition in these articles is far greater.

But manure is becoming a matter of necessity in the eastern and middle States, and this can only be obtained by the purchase of artificial fertilizers or by feeding stock on the farm. It is a question of great importance, therefore, whether we can feed cattle and sheep at a profit.

In determining this question there are several things to be taken into consideration; but we shall confine our examination to the four principal points: 1. The value of the animals when put up to fatten. 2. The amount and value of the food consumed. 3. The value of the animal when fat. 4. The value of the manure.

We need not here discuss the question of feeding animals on green food in summer, or what is generally known as "soiling." There may be sections of the country in which such a system is profitable; but, as a general rule, the advantages of the system are more than counterbalanced by the extra labor required to cut the food, attendance on the animals, &c. There can be no doubt that such a system enables us to keep more stock on a given area of land, and that we can make more and richer manure; and where land is high and labor plenty, we can adopt the system, to some extent at least, with advantage; but where land is comparatively cheap and labor scarce and dear, it cannot be adopted with profit.

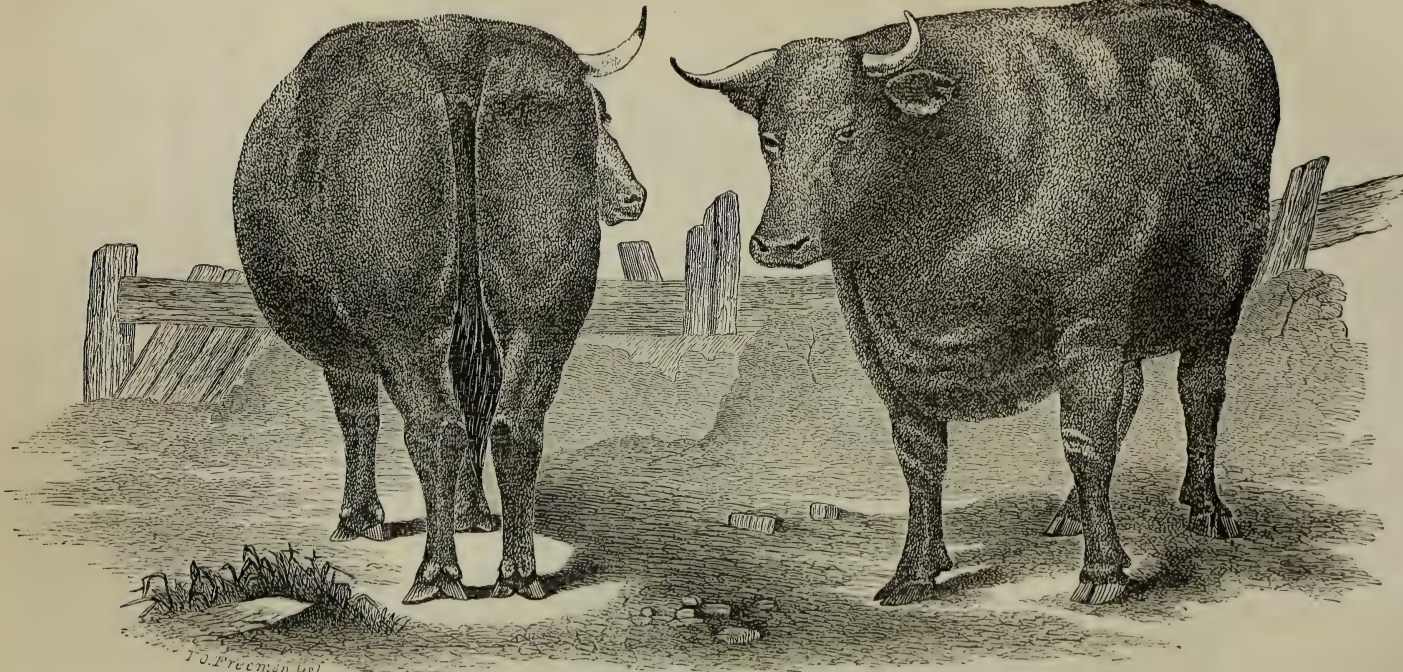
Confining, then, our attention to fattening cattle on ordinary winter food, the first question to determine is the amount of food required to produce one hundred pounds of beef. In some extensive experiments made under the direction of J. B. Lawes and Doctor Gilbert, by the late Duke of Bedford, at Woburn,* 44 Hereford and Devon bullocks consumed in fifty-three days 14,804 pounds of oil-cake, 36,097 pounds of clover hay, and 124,115 pounds of Swede turnips, *(ruta bagas,)* and increased 4,558 pounds. The mean weight of these animals was about 1,300 pounds. Mr. Lawes, from these and other experiments, concludes that fattening oxen fed liberally on good food, composed of a moderate proportion of cake or corn, some hay or straw chaff, with roots or other succulent food, and well managed, will, on the average, consume twelve or thirteen pounds of the dry substance of such mixed food per 100 pounds live weight per week, and should gain one pound of increase for twelve or thirteen pounds dry substance so consumed. In other words, a well-bred bullock, weighing say 800 pounds, would consume 100 pounds of dry substance of food per week, and would increase about eight pounds in the same time.

It is deemed better to present the statement in this form, as it is then easy to apply the figures to any food that may be used. It may be well to state that hay contains about eighty per cent. of dry substance, and Indian corn, oil-cake, &c., about eighty-five per cent., while *ruta bagas* and other roots contain only about twelve per cent.

30	pounds Indian corn or oil-cake would contain	25 pounds dry substance.
70	pounds hay would contain..................	50 pounds dry substance.
150	pounds *ruta bagas* would contain..........	18 pounds dry substance.
250	pounds would contain......................	100 pounds dry substance.

We may assume, therefore, that one bullock weighing 800 pounds will consume thirty pounds of Indian corn, seventy pounds of hay, and 150 pounds of

* Journal of the Royal Agricultural Society of England, volume xxii, 1861, page 200.



Grade Short Horn and Devon Bullocks, Six years old, weight 6,500 lbs.

(From Photograph)

roots per week, and increase eight pounds. If we omit the roots, we must increase the hay and corn; we must add, say, thirteen pounds of corn and twenty pounds of hay in place of the 150 pounds of roots.

According to these figures, therefore, a bullock weighing 800 pounds would consume forty-three pounds of corn and ninety pounds of hay per week, and increase eight pounds.

Better results than these are not unfrequently obtained with individual animals; but if a lot of cattle, when fed for three or four months, come up to these figures, the farmer may be satisfied. If one bushel of corn and 100 pounds of hay produce ten pounds of beef, it will be fully as much as is obtained under the best systems of feeding.

Will such feeding pay? Manifestly, in the eastern and middle States it will not if the value of the manure is not taken into consideration.

What is the value of the manure? There is no better way of deciding this question than to determine what substances the manure *contains*, and then ascertain the cost of these substances in the cheapest form in which they can be purchased in the market. It may be objected to this method, that it does not show the real value of the manure to the farmer—that it does not show the effect of such manure on the land. This is true: that point cannot be determined in any way that shall be applicable in all cases. A ton of manure may have a far greater effect on one farm than on another. But this does not affect the real value of the manure. We may safely assume that the majority of our farms need manure, and that it is an object to increase the supply. In such a case, what will the manure cost? What can it be purchased for in the cheapest form? What will those who have it sell it for? What can it be purchased for in the city? What can the substances which the manure contains be obtained for? *The value* of the manure would be determined by the answer to these questions, just as the value of a bushel of wheat is determined by its price in the market.

Taking this view of the subject, it is quite an easy matter to determine the value of manure. It would depend on its composition. A ton of ordinary barn-yard manure contains—

Water	1,589	pounds.
Carbonaceous matter, (oxygen, hydrogen, and carbon)	272	"
Nitrogen	8	"
Potash and soda	11	"
Lime	12	"
Magnesia	5	"
Phosphoric acid	4	"
Sulphuric acid	3	"
Chlorine	1	"
Silica or sand	89	"
Oxide of iron and alumina	6	"
	2,000	"

Now, if we ascertain the value of these substances, we determine the value of a ton of manure. A bushel of unleached wood ashes, ten pounds of common salt, six pounds of bone dust, and two pounds of plaster, contain as much potash, soda and lime, magnesia, phosphoric acid, sulphuric acid and chlorine, as one ton of ordinary barn-yard manure. These substances can be purchased for about fifteen cents.* Now, these are all the substances in the manure, except the silica or sand, oxide of iron and alumina, carbonaceous matter, water, and

*NOTE FROM DEP'T.—This calculation is undoubtedly too low for most parts of the country, though the argument is not affected.

nitrogen. The silica, (sand,) oxide of iron, and alumina, (clay,) and the water may be left out of the calculation. All we have left, therefore, is the carbonaceous matter and nitrogen. The 272 pounds of carbonaceous matter cannot be estimated at over five cents, as muck, peat, straw, and other substances afford a large and ready supply of it. We may, therefore, say that all the constituents of a ton of ordinary barn-yard manure, except the nitrogen, can be purchased for twenty cents. All that we have to determine, therefore, is the value of the remaining eight pounds of nitrogen. It cannot be purchased in any available form for less than twelve and a half cents per pound, and we do not know of any source at the present time where it can be obtained at so low a figure. The eight pounds of nitrogen, therefore, are worth one dollar a ton of ordinary manure; therefore it is worth one dollar and twenty cents delivered on the farm.

We say *ordinary* barn-yard manure. Some manure contains twice or three times as much of the valuable constituents of manures as others, and consequently is twice or three times as valuable. There are those who think manure is manure, no matter from what it is produced. This is not the case. A ton of manure made from clover hay is worth twice as much as a ton made from straw. As a general rule, the better the animal is fed, the richer and better will be the manure. From numerous analyses and from actual experiments, J. B. Lawes, of England, estimates the manure made by the consumption of a ton of food as follows:

Description of food.	Estimated money value of the manure from one ton of each food.
1. Decorticated cotton-seed cake	$27 86
2. Rape cake	21 01
3. Linseed cake	19 72
4. Malt dust	18 21
5. Lentils	16 51
6. Linseed	15 65
7. Tares	15 75
8. Brans	15 75
9. Peas	13 38
10. Locust beans	4 81
11. Oats	7 40
12. Wheat	7 08
13. Indian corn	6 65
14. Malt	6 65
15. Barley	6 32
16. Clover hay	9 64
17. Meadow hay	6 43
18. Oat straw	2 90
19. Wheat straw	2 68
20. Barley straw	2 25
21. Potatos	1 50
22. Mangolds	1 07
23. Swedish turnips	91
24. Common turnips	86
25. Carrots	86

That these figures indicate the relative value of manures made from these different foods correctly there can be no doubt. In other words, if the manure made by animals eating a ton of wheat straw is worth $2 68, that made from hay is worth $6 43, and that from a ton of clover hay is worth $9 64. We do not claim that the manure is actually worth these sums. All that is claimed is, that these figures indicate the comparative value of the manures. There are many sections of the country in which manures are not as valuable

as here estimated; but throughout the Atlantic States, where manure is much needed, there is no general source from which fertilizing matter can be obtained at a cheap rate. Many farmers in the eastern and middle States are now purchasing artificial manures, such as guano, fish manure, poudrette, &c., and certainly they pay for the substances which these manures contain fully as high rates as the above estimates.

How, then, stands the question in regard to the profits of stall-feeding? Assume that a bullock eats a hundred pounds of hay and a bushel of corn per week, and increases 10 pounds, he would in 20 weeks eat one ton of hay and 20 bushels of corn, and have gained 200 pounds. Estimate the ton of hay at $10, and the corn at 60 cents per bushel, the food would cost: hay, $10; corn, $12; total, $22. In return for this $22 we have 200 pounds of beef, worth, say eight cents per pound, or $16, and manure worth, according to the above table, $10 25.* This would give a total of $26 25 for the $22 worth of food eaten by the animals. In other words, we gain $4 25 to pay for attendance.

If, instead of meadow hay, clover hay was fed, the manure would be worth $3 21 more, and increase the profits accordingly.

It will be seen that the profits of stall-feeding cattle are not large, if we depend solely on the increase of beef and the value of the manure. As a matter of fact, however, this is not all that those who are in the habit of fattening cattle in winter depend upon for profit. They aim to buy cheap and sell dear. In this way large profits are frequently realized. Lean or half-fat cattle in the fall are usually not worth nearly as much per pound as they are when fat in the winter or early spring months, and the profit of feeding is much more dependent on the increased value of the cattle per pound than on the increase of the animal during the fattening period. Here is an instance in point: A farmer in this section had two heifers, for which he was offered, November 1, 1862, $45, and this was all they would bring in the market. He concluded to keep them, and gave them a few roots, some cornstalks, a little hay and corn meal, until the 24th of January, 1863, (twelve weeks,) and then sold them for $92 50.

I do not know how much food the two heifers consumed; but assuming that they ate what was equivalent to 2,400 pounds of hay, and 24 bushels of corn, worth (hay at $10 per ton, and corn at 60 cents per bushel) $26 40, we have a profit of $21 10, besides the manure. This is a very handsome profit, and nothing could pay the farmer better; but the reason of this large profit is not owing to the increase of the animal, but to the advance in the price of beef.

THE BEST METHOD OF STALL FEEDING.

In England there are three different methods of stall-feeding cattle: first, in stalls; second, in loose boxes: third, in sheds. Colonel McDonald, of Logan, Scotland, a gentleman of large experience, made some experiments to determine which of the three modes was the most profitable. He took twelve head of Galloway bullocks, two and a half years old, and divided them into three lots, four being placed in loose houses or boxes, four in stalls, and four in sheds. All three lots had the same kind of food. They were fed from the 22d of December to the 16th of April. For the first fifty-seven days each bullock was allowed one hundred and sixteen pounds of Swede turnips per day, divided into three feeds, and four pounds of bean meal daily, along with the noonday meal; and for the remaining fifty-seven days, fifty-eight pounds of Swede turnips per day, given morning and evening, and three pounds of cut straw, boiled with four pounds of bean meal, for the mid-day feed. All the cattle consumed four and a half pounds of fodder per day, three-fourths of the time oat straw, and one-fourth wheat.

* Manure from a ton of meadow hay, worth $6 43; manure from 20 bushels of corn, at $6 65 per ton, $3 82; total, $10 25.

Table showing the increase of twelve head of cattle, in three lots of four each, fed in boxes, and stalls, and sheds, on the same food, for sixteen weeks and two days.

Where fed.	Live weight of four cattle, Dec. 22.	Live weight of four cattle, April 14.	Increase in 116 days.	Increase per head per month.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
No. 1. Loose boxes	4,039	4,698	659	10.31
No. 2. Sheds	3,937	4,549	612	9.56
No. 3. Stalls	4,019	4,550	531	8.29

Of the three plans of feeding that in boxes gives the best results, in sheds next, and in stalls the least. There are two drawbacks to feeding in boxes. The loose boxes cost more than stalls, and more straw is also needed for litter. Colonel McDonald states that each stall-fed animal uses about one ton of straw for litter during the six months of feeding, while each box-fed animal required nearly three tons. Where straw is valued as an article of food the two tons saved on each animal by the system of feeding in stalls gives it a manifest superiority over the loose boxes.

In regard to feeding in sheds, it must be remembered that the weather was very wet; and though the open sheds and yard were in a sheltered situation, it is quite possible that in our drier climate the results would not be so much against the practice of feeding in open sheds. The labor of attending to cattle in open sheds is less than in boxes or stalls. Colonel McD. estimates the expense of attendance in the two latter at twenty-five cents per month, and in sheds at eighteen cents per head per month.

The fact that the animals gained the most in the loose boxes, where they move about more or less, but are at the same time kept warm and dry, shows that too close confinement, as in stalls, is to be guarded against. Colonel McDonald says: "With an annual experience of fattening upwards of two hundred and fifty cattle in stalls and boxes, we find that from eighty to one hundred pounds of cut Swedes (ruta bagas) per day, given in two feeds, morning and afternoon, and a cooked feed at noon, is quite sufficient to fatten cattle of from forty to fifty stones imperial. The substitution of the cooked mid-day meal has enabled us to increase our fattening cattle by one-third in number, leaving a proportionately small return per acre for turnips consumed, and a great increase of valuable manure. Economy in feeding is the first secret of success in making the turnip crop pay. A certain effect must not only be produced in a given time, but it must be produced at a given cost. As yet we have found nothing equally nutritive and so cheap as two feeds of raw Swedes per day, and four pounds of bean meal cooked, with an equal weight of cut straw, given as the mid-day feed."

In other words, Colonel McD. is not in favor of feeding such an excessive quantity of roots as is generally practiced in England and Scotland. With us, however, there is no danger of running into this error: we feed too few rather than too many roots.

In regard to the best roots for cattle, we may mention that, from Colonel McDonald's experiments, it was found that the increase of animals, after deducting the cost of the artificial food in each case, left five and a quarter pence per hundred weight for mangold wurzel, four and a half for white carrots, and three and three-quarters pence for Swede turnips, or ruta bagas. In commenting on these facts the late Philip Pusey says: "It is as easy to grow thirty tons of mangold wurzel as it is to grow twenty tons of Swedes to the acre. Assuming Colonel McDonald's results to be such as would ordinarily take place, the superior profits of mangolds over Swedes is very great, for the money returns will stand as follows: Mangolds, £13 2*s.* 6*d.*; Swedes, £6 5*s.* The money return for the mangolds, therefore, appears to more than double that for the Swedes."

In the drier climate of the United States there can be no doubt that mangold wurzels have several advantages over Swedes. They are sown earlier, and are not so liable to injury from hot, dry weather, or from insects. They produce more per acre, and are much more nutritious. The only drawback is that they need higher cultivation, and are not ripe enough to feed until the middle of winter. On the other hand, they will keep later in the spring.

STALL-FEEDING SHEEP.

If we use the term stall-feeding in its strictest sense, it is not applicable to the plans usually adopted in fattening sheep. In England, it is true, sheep are now extensively fed under cover, on narrow boards, with interstices of an inch or so between them for the droppings to fall through. In this way the sheep are always dry and clean, no straw being used. The boards are about two and a half inches wide, and are placed about two and a half feet from the ground. The droppings are scraped away from under the floor on the back side of the shed. In fattening sheep in winter, in this country, we meet with the same state of facts as in regard to fattening cattle. The mere *increase of the animals* certainly will not pay for the food consumed; and even if we add the value of the manure the profits are not large, if any. But if lean sheep are purchased at the ordinary prices at which they are sold in the fall, and judiciously fattened till February or March, and sold at the advanced price which fat sheep then usually command, no system of agriculture can be more profitable. How long such a state of facts will continue it is impossible to tell. It would seem, when the farmers ascertain how profitable the system can be made, that there will not be found so many who are willing to dispose of their lean sheep in the fall at low figures, and that, consequently, the profits of fattening will be much less.

In England lean sheep generally bring as high a price *per pound* in the fall as they bring *per pound* in the spring, when fat; and the farmer has to depend for his profit on the value of the manure and the simple increase of the animal in return for the food consumed.

The profits of fattening sheep the present winter (1862–'63) have been unusually great. It is always said to be the case *when grain brings a high price.* Last October sheep brought a full average price, but this was due solely to the high price of wool. Pelts in New York sold for $1 43 each. Deducting this from the price paid for the sheep, and the price paid for the *mutton* was low, indeed. In fact, it is stated that mutton was sold by the carcase, in New York, in the middle of October, for two cents per pound. At the present time (February, 1863) it is worth eight cents per pound. Pelts, too, have advanced to $3 25 on an average; many bring higher.

This, it will be said, is a state of things quite out of the ordinary course. This is true; but, taking the average of the past few years, sheep are always sufficiently higher in the spring, as compared with the price in the fall, to afford a good profit on winter feeding. We may safely assume that a lean sheep,

worth three cents per pound in the fall, live weight, will be worth five cents per pound, live weight, when fat, in February or March.

Let us take as an illustration a sheep that weighs seventy pounds the middle of October; at three cents per pound he is worth $2 10. Feed such a sheep sixteen weeks, or till the middle of February, and if he gains twenty pounds, (one and a fourth pound per week,) he will then weigh ninety pounds, and will be worth, at five cents per pound, $4 50; this will leave $2 40 to pay for the food consumed. Such a sheep will eat two hundred and seventy-five pounds of hay, or its equivalent, in the sixteen weeks, or about two and a half pounds per day; in other words, we get $2 40 for two hundred and seventy-five pounds of hay, or $17 45 per ton. This is leaving the manure out of the question. The manure from a ton of clover hay is, as we have stated before, worth $9 64. The manure, therefore, from the two hundred and seventy-five pounds of clover hay eaten by a sheep in sixteen weeks, is worth $1 32; this, added to the increased value of the sheep, would make the entire return for the two hundred and seventy-five pounds of clover hay $3 72, or $27 per ton.

The present season the profits have been far greater. Instead of five cents per pound, good sheep are now selling at eight cents per pound, live weight.

There is no better fodder for sheep than clover hay cut into chaff, but it is not desirable to feed them exclusively on this food; they should have a little grain or oil-cake, and on farms where straw is abundant it will be cheaper to feed more grain and less hay, allowing the sheep all the straw they will eat.

There are few questions of more importance in agriculture than the nutritive value of straw. Unfortunately, we have few experimental data on which to base a satisfactory opinion on the point. If we consult British authorities, we shall come to the conclusion that straw was not of much value as food for fattening cattle or sheep. The opinion of farmers in this country would be more favorable. It is certainly a fact that American farmers place more reliance on straw, to enable them to carry their animals through the winter, than English farmers. Probably the truth lies between the two extremes; in England straw is not sufficiently esteemed, while with us it is too often overestimated. We know farmers who depend almost entirely on straw and cornstalks to carry their stock through the winter; but we apprehend that if the animals so fed were weighed in the fall and again in the spring, they would be found to have lost rather than gained in weight. An intelligent farmer in this vicinity recently remarked to us that he did not expect his sheep to gain anything during the winter; he depended solely on the advance in the price of mutton to pay for their keeping. This farmer fed his sheep on wheat straw, with a little corn meal in very cold weather.

This may be considered an "economical" way of wintering sheep; but we very much doubt if it is true economy. Animals require a large amount of food to sustain their vital functions merely, and fat is produced only from food given in excess of that amount. To allow them to consume so much food merely to keep them alive, when a little more would enable them to lay on fat and flesh, is a most wasteful practice. What should we say of a miller who furnished his engine only with fuel enough to generate steam to turn the stones, but not enough to enable them to grind any flour, and should keep the stones running empty night and day for four months, when a little more fuel would produce force enough to grind the wheat? We admit that it is not strictly a parallel case; the animals are worth more in the spring, even if they have not gained in weight. But even admitting that the flour mill would be worth more because it had been kept going for four months, it does not follow that it would not have been more profitable to have increased the amount of fuel sufficiently to have enabled it to grind the wheat, rather than only enough to turn the machinery.

High feeding is one reason of the great advancement of English agriculture during the last twenty-five years. It has enabled the farmer to keep more stock on a given amount of land, and thus to make manure. It is still an open question with them, however, whether it is profitable to feed the high-priced cereal grains. Their main dependence is the turnip crop, with clover hay, beans, peas, oil-cake, &c., as the dry food. The cereal grains, such as barley and oats, are produced only at considerable expense to the *fertility* of the *soil*, while the consumption does not improve the manure as much as peas, beans, and oil-cake. In fact, the manure from barley, oats, and corn is worth but little more than that from good clover hay.

In fattening cattle and sheep it is a question of the first importance, what food is produced at least expense to the fertilizing elements in the soil. One great object in feeding animals is to enrich the land, and it is important to know what food can be produced that will injure the land the least and enrich the manure-heap the most. When the crop is favorable, there is no crop so valuable in this twofold variety as the turnip. It is cultivated in rows which admit the use of the horse-hoe, and the plants are thinned out by the hand-hoe, about a foot apart; the land, therefore, is made very clean. It is essential, indeed, to the success of the crop, that the land should be made very mellow and kept scrupulously free from weeds during its growth. It takes the place, indeed, of the old-fashioned summer fallow, and for this reason is called a fallow-crop. Then a large amount of food is produced on an acre at comparatively little cost to the soil, and the consumption of this food produces a large quantity of excellent manure.

Next to the turnip, red clover is the most enriching crop; it is far better suited to our climate than the turnip; in fact, there is no country in the world where red clover flourishes better than throughout a large section of the United States. It is pre-eminently the renovating crop of the country. It is almost impossible to grow too much of it, provided it is consumed on the farm. It makes the best of all hay for sheep, and, as we have before said, the manure from it is nearly as valuable as that from corn; far more valuable than that from ordinary hay.

Peas and beans are also renovating crops. They impoverish the soil but little, and make richer manure than any other crop.

Rape has been tried but little as yet, but, if found adapted to the climate, deserves a high place among our renovating crops. The same may be said of lupins and spurry. They are eminently worthy of a trial.

The great aim, then, of every farmer should be to grow such crops as food for stock as impoverish the soil the least, and make the richest manure. These, as we have said, are turnips, clover, peas, and beans. The more we grow of these crops, and the more stock we keep, the richer will our land become. We shall sow less land to wheat and other cereals, but from the richness of the soil shall get larger crops.

BEEF AND BEEF-CATTLE OF THE WEST.

BY W. W. CORBETT, OF CHICAGO.

It is flattering to western men to have celebrated travellers and authors from abroad publish, upon their return to their native lands, that they have found this country, scarce half a century old, and with its resources just beginning to develop, the granary of the world. It is with feelings of pride that they read from foreign pens accounts of our prairies waving like oceans with wheat and tasselling corn; our immense warehouses groaning with the weight of food waiting for shipping facilities to bear it to less-favored peoples. Still, when all this has been said, every thorough western man knows that the story of our agricultural greatness is but half told. The great stock interests of the western States have, by these writers, been in a measure overlooked. These prairies that feed Europe with their surplus grains, graze numberless flocks and herds upon their thousand slopes. These railroad webs that stretch over our vast expanse of territory bear upon their iron threads more than wheat and corn to empty into our lake and river ports. The concentrated products of the prairies—the golden cornfields, the luxuriant grasses, the water, and the air—in the form of beef-cattle, constitute a large part of their burdens, while thousands more, on foot, throng the highways to the eastern marts. More than the "*granary* of the world" is the west. She is the great *meat manufactory* of the world also.

In proof of these remarks, I can do no better, perhaps, than to give some of the statistics of the slaughter and shipment of cattle at Chicago for the past few years. I give the monthly shipments of the last two years, as they will afford some information concerning the time of year our stock-feeders and growers consider the best for realizing upon their cattle. During the year 1859 there were received at Chicago 111,694 head of cattle. These were disposed of as follows:

Forwarded by Michigan Southern and Northern Indiana railroad..	16,337
Forwarded by Michigan Central railroad	11,789
Forwarded by Pittsburg, Fort Wayne, and Chicago railroad	6,463
Forwarded by Chicago and Milwaukee railroad	1,033
Forwarded by Illinois Central railroad	370
Forwarded by Chicago and Rock Island railroad	262
Forwarded by Chicago, Alton, and St. Louis railroad	217
Forwarded by Chicago, Burlington, and Quincy railroad	108
Total railroad transportation	36,579
Transportation by lake	1,005
Slaughtered by packers	51,506
City consumption	22,504
	111,694

In 1860 there were received at the same point 177,101 head of cattle—an increase of 65,407 over the year 1859. These were disposed of as follows:

Shipped by lake	1,129
Forwarded by Illinois Central railroad	338
Forwarded by Chicago, Burlington, and Quincy railroad	200
Forwarded by Chicago, Alton, and St. Louis railroad	179
Forwarded by Chicago and Milwaukee railroad	1,084
Forwarded by Michigan Southern railroad	34,264
Forwarded by Michigan Central railroad	31,502
Forwarded by Pittsburg, Fort Wayne, and Chicago railroad	28,778
Total transportation	97,474
Slaughtered by packers	34,623
City consumption	42,074
	177,101

In 1861 there were received by railroads 164,579 head, and estimated driven in on foot, 40,000, making a total of 204,579 head. They were forwarded monthly as follows:

	Lake transportation.	Chicago and Rock Island railroad.	Illinois Central railroad.	Chicago, Burlington, and Quincy railroad.	Chicago, Alton, and St. Louis railroad.	Chicago and Milwaukie railroad.	Michigan Central railroad.	Michigan Southern railroad.	Pittsburg, Fort Wayne, and Chicago railroad.	Totals of the months.
January	......	......	......	......	1	....	3,241	1,740	1,292	6,274
February	......	......	......	......	16	20	2,103	3,100	1,625	6,864
March	......	22	7	4	....	1	3,764	5,069	3,046	11,913
April	......	35	107	54	26	2	5,213	6,177	3,793	15,407
May	70	......	9	......	....	....	1,192	5,222	6,354	12,847
June	43	27	67	......	76	....	4,982	5,253	4,247	14,695
July	148	......	58	2	....	72	3,284	3,953	3,730	11,247
August	120	......	15	16	....	324	2,696	4,597	3,760	11,528
September	126	32	310	82	....	252	3,356	11,631	1,904	17,693
October	181	62	161	19	930	1,318	998	1,486	2,209	7,364
November	57	......	195	32	1,246	341	380	85	775	3,111
December	......	......	......	5	....	19	2,300	2,445	434	5,203
Total	745	178	929	214	2,295	2,349	33,509	50,758	33,169	124,146
Slaughtered by packers	......	......	......	......	....	....	....	....	....	53,754
City consumption	......	......	......	......	....	....	....	....	....	26,679
										204,579

During the last year (1862) the total number received by railroad was 184,655; driven on foot, 25,000; total, 209,655 head. These were disposed of as follows:

Number received during the year 1862.

	Lake transportation.	Chicago and Rock Island railroad.	Illinois Central railroad.	Chicago, Burlington, and Quincy railroad.	Chicago, Alton, and St. Louis railroad.	Chicago and Milwaukee railroad.	Michigan Central railroad.	Michigan Southern railroad.	Pittsburg, Ft. Wayne, and Chicago railroad.	Totals of the months.
January	......	......	121	4	....	163	557	555	2, 969	4, 369
February	......	......	12	......	....	....	685	2, 169	3, 516	6, 382
March	......	......	30	......	1	....	3, 089	2, 442	3, 808	9, 370
April	67	......	45	3	20	100	3, 927	3, 448	4, 734	12, 344
May	78	145	2	......	....	15	5, 316	5, 499	9, 410	20, 465
June	27	......	64	2	....	75	....	6, 477	7, 248	13, 893
July	158	......	......	......	42	60	3, 356	4, 613	6. 161	14, 390
August	136	......	60	......	136	90	2, 186	2, 334	3, 123	8, 065
September	77	......	356	96	619	375	1, 413	1, 434	4, 376	8, 746
October	99	160	378	81	186	405	1, 155	700	1, 700	4, 864
November	93	......	414	......	132	30	313	752	4, 128	5, 862
December	......	......	132	......	200	25	1, 840	214	1, 584	3, 995
Total	735	305	1, 614	186	1, 336	1, 338	23, 837	30, 637	52, 757	112, 745
Slaughtered by packers	......	......	......	......	....	....	....	....	....	59, 687
City consumption	......	......	......	......	....	....	....	....	....	37, 223
										209, 655

There may also be added to these figures the number shipped over the Michigan Central railroad, received at Lake Station, from the Joliet cut-off—in 1861, 8,563 head of cattle, and in 1862, from the same source, 41,592.

The Great Western railroad, running through the central portion of Illinois, and connecting with the Wabash Valley road at State Line, carried during the year 1862, 40,230 head.

A more comprehensive view of the number and value of the cattle of the northwest may be had from the returns of the last United States census—1860. This gives to

	Milch cows.	Working cattle.	Other cattle.
Illinois	532,731	90,973	881,877
Kansas	26,726	20,133	41,000
Nebraska	7,125	12,720	8,870
Minnesota	40,386	27,574	51,043
Wisconsin	193,996	93,660	225,210
Michigan	200,635	65,949	267,683
Missouri	345,243	166,588	657,153
Iowa	188,546	56,563	291,145
Total	1,535,388	534,160	2,423,981

Add to these the number returned by the assistant United States marshals, as the probable number owned in villages and towns and elsewhere, not included in the above, as follows:

Illinois	218,459
Kansas	34,938
Nebraska	2,484
Minnesota	29,823
Wisconsin	120,450
Michigan	80,760
Missouri	118,181
Iowa	94,184
Total	699,279

And we have a grand total of 5,192,808 head of cattle within the territory mentioned. It is to be regretted that these States, generally, have not a yearly census, that these figures might be brought down to a later period. The enormous increase here can, however, be understood when it is stated that in most of them the number of live stock has increased more than one-half since the census of 1850, and in several of them to a much greater extent. Should this vast number of cattle be estimated at $10 per head, (certainly not a very high estimate at present prices for beef cattle,) we should have the immense sum of $50,109,280 in the year 1860.

From the Iowa assessors' returns for 1862, William Duane Wilson, secretary of the Iowa Agricultural College, writes me that, of all the counties except fourteen in that State, there is an aggregate of 565,352 head of cattle. He says:

"Estimating those from which no returns have been received, including but six counties of any consequence, at the ratio of those which have returned, those not reported will be very near 80,000, making the total 645,352. We are satisfied that at least ten per cent. should be added to this number for cattle not returned to the assessors, which will make the total over 700,000 head. As the average reported assessed value per head is a fraction over nine dollars, it is fair to presume that at least three-fourths of the whole are cattle ready for the market, or milch cows. After deducting 300,000 as the probable number of cows, there are left 225,000 head for the shambles. Deducting again 50,000 for home consumption, the probable number for export for 1862 will be 175,000. The number of cattle reported in census returns as sold in 1858 was 141,146, at an aggregate value of $2,950,187, being a fraction over twenty dollars per head. The increase, therefore, of near 34,000, is not too great to set down for 1862, a period of between three and four years having intervened."

Having thus given some idea of the number of cattle in the northwest, it may be interesting to consider for a moment the sources from which they originally came, their character as regards blood, &c., the manner of rearing and feeding, and other matters connected therewith.

Ohio and Kentucky being older settled States, and their people giving early attention to stock-raising, gave to Illinois her first instalments of cattle, if we except the small French cattle brought at a very early period by the French settlers of southern Illinois, but which are now extinct, and have left no trace among the cattle of the present day. Though the character of the cattle of the first-mentioned States has been greatly improved since then, yet Illinois and the west have no cause to complain of the native cattle which were so freely drawn from them. Later, as the adaptability of the States further west for the production of beef became known, and they became rapidly settled with an enterprising people, vast numbers of cattle flowed in from Texas and Missouri, on whose plains, seemingly the natural home of horned cattle, they multiplied like fishes in the upper lakes. There they seemed to breed and thrive without care or expense. The proximity of Illinois and Iowa to market, as well as the peculiar adaptability of the rich prairie grasses for grazing, and the ease with which corn and other grains can be produced for fattening purposes, together with the temperate climate with which they are blessed, have established these States, and similar territory to the westward, as the great localities for either the producing or the finishing process of beef-making.

Even up to the breaking out of the present rebellion it has been the custom of our drovers and breeders to visit those States, which we may call the supply States, investing largely and profitably in the young stock of the Missouri and Texas breeders. Such cattle have also, of late years, been brought to the packing market of Chicago direct, coming through Missouri and Iowa to the Mississippi river, grazing by the way, and from thence transported by rail to the shambles. In 1859 the drovers met with a scarcity of grass, and with forcible opposition from the rebel Missourians to the passage of stock through their country to a northern market. It has been ascertained that in the neighborhood of 80,000 head of Texas cattle were thus prevented from coming forward. Now the trade from both States has been nearly destroyed, and unless calves are reared in much larger numbers by the farmers of these more strictly northwestern States, there must be a marked diminution in the amount of beef and beef cattle for the eastern market. There can be no doubt of this, though the figures, as yet, do not indicate such falling off.

This much in reference to the introduction of the native stock, which forms the basis of the western supply of beef. This stock, though hardy, strictly acclimated, and possessing good fattening qualities, failed long since to fulfil the requirements of the breeders of Illinois and the west. These enterprising and intelligent men could see no reason why such a country as that which we possess should not rival or even surpass that paradise of beef-eaters, old England, in the production of fine beef. Consequently, neither time nor money have been spared in procuring the best specimens of the best breeds of beef and work cattle, so that the west, to-day, has numerous herds of Short-horns, Devons, Ayrshires, and Alderneys, that she would not fear to put in competition with the most celebrated herds of New York or Massachusetts, or even those of the famed breeders of England itself.

At the United States fair, held at Chicago in 1859, there were eighty-three premiums paid on cattle of all classes. Of these Illinois exhibitors received thirty-six; Iowa, ten; Ohio, nine; New York, seven; Maryland, twenty; Michigan, one; Canada, one; two western States receiving more than one-half the whole number of awards. And he who has attended the last four or five exhibitions of the Illinois State Agricultural Society will not fail to award to this comparatively young State full meed of praise for her fine Durham and Devon herds.

Probably the first blooded Durhams of Illinois came from the Kentucky importations, and were introduced into the southern and central parts by gentlemen who had received their taste for fine stock in their boyhood days in that "daughter of old Virginia." As early as 1833 James N. Brown, the most extensive and successful breeder of Durham stock in the west, and J. D. Smith, brought a few head of the best Kentucky stock into Sangamon county, Illinois, and from this beginning, with judicious crossing and management, they have succeeded in producing a herd of pure bred Durhams, of which any State or any country might be justly proud. Other gentlemen in the central and northern parts of the State—among whom may be mentioned the Dunlaps, of Morgan county; Iles, Bone, and Jacoby, of Sangamon; Barnett, of Will; Thomas and Carle, of Champaign; Wentworth, of Cook, and many others—early turned their attention to the improvement of Illinois stock. These men and others, not satisfied with the crossing that could be obtained from the best specimens of animals from both south and east, formed themselves, in 1857, into an association called "The Illinois Stock Importing Association," and appointed James N. Brown, H. C. Johns, and Henry Jacoby, agents to visit England and purchase stock. They had a capital of $25,000 to operate with. They left New York in March, 1857, made their purchases in April and May, and reached home toward the last of July. Owing to unfavorable weather, the cattle were sixty days upon the water, during which time several head died, and the rest were landed in bad condition. On the 27th of August the cattle

were sold at auction, on the fair grounds at Springfield. The following is a list of the animals, the purchasers, and the price paid for each animal:

COWS.

Name.	Age.	Purchaser.	County.	Price.
Bella	Five years	J. Ogle	St. Clair	$750
Caroline	Four years	J. N. Hill	Cass	500
Stella	Four years	Mr. Bohnman	St. Clair	925
Lady Harriet	Three years	James Jacoby	Sangamon	1,300
Cassandra	Three years	H. Ousley	Sangamon	675
Western Lady	Two years	J. N. Brown	Sangamon	1,325
Empress Eugenie	Two years	J. Ogle	St. Clair	675
Pomegranate	Two years	T. Sumpkins	Pike	975
Lily	Two years	G. Barnett	Will	550
Constance	Three years	G. Barnett	Will	700
Empress	Two years	J. Jacoby	Sangamon	1,725
Rachel, 2d	Two years	J. N. Brown	Sangamon	3,025
Minx	One year	J. G. Lorse	Sangamon	800
Adelaide	One year	R. Morrison	Morgan	825
Emerald	One year	J. C. Bone	Sangamon	2,125
Perfection	One year	E. B. Hitt	Scott	900
Coquette	One year	G. Barnett	Will	550
Fama	One year	Spears & Co	Menard	1,050
Coronation	One year	J. A. Prickett	Madison	500
Violet	One year	J. W. Judy	Menard	700

BULLS.

Name.	Age.	Purchaser.	County.	Price.
Defender	Three years	J. H. Thomas	Champaign	$2,500
King Alfred	Two years	J. Jacoby	Sangamon	1,300
Admiral	Two years	S. Dunlap	Morgan	2,500
Master Lownds	Two years	J. H. Spears	Menard	725
Argus	Two years	B. Saunders	Jersey	2,058
Doubloon	One year	W. Iles	Sangamon	1,075
Goldfinder	One year	J. W. Judy	Menard	725

Though these cattle were distributed over all parts of the State, and though different breeders have since, from time to time, purchased from the different herds of New York and Massachusetts, and brought them into the northern as well as central and southern parts of the State, yet the Durhams seem to have found their most natural home in the latter two portions. There they have been bred pure, and have also been crossed very extensively with the native stock, till it is not improbable that nine-tenths of all the market cattle sent from Illinois have a strain of Durham blood. The climate there seems especially suited to the perfecting of this breed. In northern Illinois, and in Iowa and Wisconsin, however, they have not succeeded as well; and with the majority of intelligent breeders, the smaller, hardier Devons are preferred, though it cannot yet be said that they are very widely disseminated, or that they have imparted any of their general characteristics to the mass of northern cattle. They are, I think, as they are becoming better known, increasing in popularity, and the time is not far distant when the peculiar Devon traits will be easily traced among the cattle of this latitude, to which they are undoubtedly particularly adapted. Probably the finest Devon stock in the west were brought here by Colonel Horace Capron, who for several years bred them quite extensively and very successfully in McHenry county, Illinois. He brought them from Maryland, where they had descended from the stock sent there by the Earl of Leicester. The other eastern importations of Devon stock, of both

strains, have, at various times, been drawn upon by different western breeders. among the principal of whom may be mentioned Hon. John Wentworth, of Cook county, Illinois.

From improved blood, and from better breeding and management, the character of western beef cattle has advanced in the last seven years, as the statistics of the markets both here and at the east conclusively demonstrate. Our heaviest cattle are sent eastward, and any market report of any extent will show that the average weight of western beeves is far greater than that from any other part of the country. In New York the present average weight of slaughtered animals will not vary much from 800 pounds net, while seven years ago it was not over 600 pounds. In Chicago, in 1852, the average weight of cattle packed was 542 pounds, while in 1860 it was 600 pounds. There can be no doubt that the average of western beef cattle, when marketed, is as high as 750 pounds each.

Many of the fancy fat cattle slaughtered in this country are from the west. The "Christmas beef" in western cities, especially Chicago and St. Louis, is as fine as was ever exposed for sale in the most noted English markets. Indeed, I have heard many Englishmen, within the last year, say that they have never seen as fine beef as that presented at some of the Chicago meat-stalls during the holidays; and it is but a just tribute to that noble breed, as well as to the favorable character of the west for their perfection, to say that this prize beef is from what may be termed the American Durhams, either pure or graded.

Owing to the peculiar character of the west, and the extensiveness of the business, beef-making differs in many respects from that of any country in the world. It is not attended with the same care or labor as at the east, where a severer winter makes it absolutely necessary to feed young stock during nearly one-half the year, and likewise to shed or stable them. Nor can it here be done without some care for a short period during winter, as on the pampas of South America and the plains of Texas. We have here a sort of happy combination of the two conditions: a mild climate, for the most part, and a soil inexhaustible in its resources for the production of just such food as cattle best thrive upon when dependent upon the care of man.

The greatest proportion of western cattle are forwarded to market when at from three to five years old, the mean being four years. The general practice among large growers is what is here called, or miscalled, *stall-feeding*. It would naturally be supposed, by those unacquainted with western beef-making, that by stall-feeding is meant feeding in stables or sheds, with ground feed, slops, roots, &c.; but such is not the case. The great mass of cattle fattened here are never stabled, or even sheltered by sheds, their only protection from inclement weather being that afforded by groves or belts of trees, and even these are often of but little use against prairie winds and storms. Still the best feeders select localities where their stock may have the most of such protection. Where from one hundred to one thousand head, or more, are fitted for market on a single farm, it will at once be apparent that tying up in stalls and feeding, in the manner that our eastern friends fit a dozen or twenty head, would be altogether impracticable, though there might be some economy in food. In the grazing region of central Illinois, and corresponding latitudes to the westward, cattle feed upon the prairie grasses and rich blue grass that seems to come in upon all prairie land almost spontaneously, from early spring until December, generally on prairie grass from May to September, and on the tame-grass pasture the balance of the time. The great prairie ranges admit of herding in large herds with the care of but few men, and, at the same time, give great change of pastures. Salt is given them freely, and they are driven to the best water the country may afford, either running streams, or that which collects in sloughs from the abundant winter and spring rains and the occasional showers of summer. When put upon the cultivated pastures it is the general practice to have two or more

fields for a change. This gives fresh pasture—a very necessary thing for rapid fattening—and at the same time keeps the pastures in good condition for winter grazing, which is a consideration not to be overlooked by those who would succeed best in localities where winter grazing is possible. The best breeders and feeders also take great pains to have their tame pastures sown with different grasses, so as to yield the best succession of feed, some being best adapted to early, and others to late feeding. In the territory further north the prairie ranges are less, and in many cases the country is so thickly settled that tame pasture is almost the only resort. Here, all through the season, change of pasture is practiced, and for reasons similar to those above stated.

As soon as the grasses begin to fail in the fall, (the time, of course, varying with the latitude,) the stall-feeding, as it is termed, commences. The almost universal feed from this time onward until spring is corn from the shock, drawn on low wagons or sleds for the purpose, and thrown to the cattle, stalks and all, beginning with a small quantity, and gradually increasing as grass fails and rapid fattening is desired—the maximum being from half a bushel to three pecks a head per day. One man will thus care for about one hundred head, which is about the largest number that thrives well in one body. Two lots or feeding-yards are used, each on alternate days. As there would be great waste from this mode of feeding from tramping under foot, overfeeding, &c., were not some means provided by which it could be prevented, the plan of allowing swine to follow the cattle and pick up the remnants has been generally adopted. From one to two head of hogs to one of cattle will thus not only get a living, but fatten upon what would otherwise be a total loss.

This method of beef-making cannot be better understood than by giving somewhat in detail the practice of some of our beef kings, as they have been not inappropriately styled. Probably the three most extensive growers and feeders of the west are Mr. Funk, of McLean, and Messrs. Alexander and Strawn, of Morgan counties, Illinois. The account of Mr. Funk's management is as recorded in the Rural New Yorker, in 1862; and that of Mr. Strawn in the Prairie Farmer, 1861.

MR. FUNK'S METHOD.

"Mr. Funk usually winters over from seven hundred to one thousand head of cattle, and stall-feeds for early spring market from three hundred to five hundred head. He markets his stall-fed cattle about the 1st of April. He buys cattle all the time, whenever he can do so profitably. Those he sells in the summer and fall are generally three years old. The class he stall-feeds are generally four years old." * * * * * * * * *

"He prefers to buy cattle (steers) the spring they are two years old. They usually cost then, if good ones, from \$18 to \$25 per head. These are kept one summer, one winter, and the half the next summer, when they are in condition to market, and will average from \$45 to \$52 per head. He winters his cattle on shocked corn. The steers that are to be wintered through and marketed in midsummer are 'strong-fed.' Those that are to go to market the last of March or 1st of April are 'stall-fed.' The difference in the two modes of feeding is, that the bullock that is being stall-fed gets all he can eat and a good deal more, while the one that is strong-fed gets enough to keep him thriving finely all winter, gaining in flesh and growing too. The corn is drawn from the field, on wagons, to the pasture or lot where the cattle are herded. One man feeds from seventy-five to one hundred head; and this care occupies him from early morning till late at night. He rises and eats breakfast by candle-light, and draws corn with from two to four yoke of oxen (the amount of team depending upon the condition of the soil) all day, and returns and eats his supper by candle-light again. Mr. Funk says that the true way to feed is to provide two fields for each company of cattle. Feed the cattle in one field to-day, and in the second to-morrow; to-morrow turn one hog for every strong-fed, or two hogs for every stall-fed animal into the field in which the cattle were fed to-day, changing each day, the hogs following the cattle. He says one acre of good corn will winter one bullock, if strong-fed; if stall-fed, it will require one acre and a half per bullock. The cattle have no other feed, and no protection except timber, if they happen to be feeding near it. Salts his stock with this feed about every third day, and provides them plenty of water. Beef, if fit to go to the New York market, sells here at \$3 to \$4 per cwt., gross; packing cattle at \$2 to \$2 50 per cwt., gross."

MR. STRAWN

"Buys, in preference, three and four year old steers, but takes them of all ages, if necessary. Getting them in February and March, he grazes them through summer and until December, when he commences to feed. This he formerly did as early as November, because of having had more cattle to a given quantity of land than he has at present. He keeps a man to about every hundred head, which, with his system of management, is sufficient. The cattle are fed in timber groves, and the corn is thrown on the ground, stalks and all, just as it is hauled from the field. The allowance per head, when stall-feeding, is half a bushel daily, and the large cattle get even as much as three pecks. Two hogs are turned in to each steer, to collect the waste. Mr. Strawn thinks sixty bushels a large crop of corn, and mistrusts the fabulous stories of yields that sometimes meet us in the papers.

"In the old times his practice in feeding steers was to commence in October, while the cattle were still in pasture, giving them not more than six quarts a day. After feeding them ten days he increased the allowance by one quart if the cattle were large, and always fed them at one regular hour; or, if he wished to get them fat soon, he commenced with two feeds of five quarts each by the 1st of November; by the 10th he gives two feeds of six quarts; and so, increasing slowly, he got them up to their full feed only when the cold weather came, if it should be deferred until January. By the latter part of January, or the early part of February, he would begin to feed so that the cattle would ever have beds of corn and fodder to lie upon. Mr. Strawn advises the keeping of hogs enough to eat up the waste in any event. If he fed heavily, he had half as many stock cattle as fat cattle to follow. He sells as soon as he can do so at a moderate profit, replacing the ones sold with other cattle; for he thinks that "the nimble sixpence is better than the slow shilling."

"His allowance of pasture and corn for each head of stock is two acres. In former times he bought three-year-old steers at $8, and turned them off at $16; but the prices have so advanced that he now pays from $25 to $30 per head, and sells for $50 to $60. The profit is the same as formerly, but the capital involved much greater."

Let it not be supposed that all the cattle of the west are thus reared and fattened. In the northern portions, where sheds and stables are indispensable in winter, this branch of husbandry is carried on very extensively, and is gaining in importance under the load of high freights and low prices that farmers are obliged to carry, from the want of proper facilities to transport the products of their grain-fields. In many cases the most approved systems of stall-feeding proper are practiced. Tame hay, roots, ground food, &c., are profitably fed, and no mean item of western beef is thus produced.

A large number of cattle in the west, also, are "still-fed." This is usually done in and about the large cities and towns. The poorest cattle, such as are considered too lean to ship or pack, commonly known among cattle-men as "*scallawags*," are generally chosen for this purpose. This is, as is well known, a rapid method of fattening, and it is claimed that the beef thus produced is not of an inferior character.

The cattle of the west, as a general thing, have been free from diseases for a number of years; that is, free from any epidemic or contagious diseases as are known in the old country, being subject only to such as want of care and improper food may engender at any time and in any country. In earlier days Missouri and some parts of Illinois were scourged considerably by a disease generally known as the Texas fever. Such was the case as late as 1858 and 1859, though much more extensively about 1825 or 1826. This disease has also been known in Illinois, but almost exclusively prevailing among cattle driven from Texas or Missouri. In 1858 and 1859 about three thousand head died from this or a similar disease in Macoupin county. It is probable, however, that this disease is but a type of murrain. It cannot be contagious, or it would long ago have swept over the whole country, destroying millions of cattle; for at no time have any special measures been taken to check it. Black leg and quarter ail are diseases known here, but prevail to no alarming extent in any section that I know of at present.

Considerable alarm was felt by our stock men and farmers generally at the time the *pleuro pneumonia* made its appearance in Massachusetts, and, ever watchful of this great interest, prominent breeders at once put forth exertions to prevent its introduction among our western herds. The governor of Illinois

issued a proclamation recommending the farmers, drovers, and others, not to import into the State, cattle that could, by any possibility, be infected with the disease, and calling upon all to watch, with the greatest care, any appearance of this disease in the State, and, if discovered, to report at once to the secretary of the State Agricultural Society, that immediate measures for its extermination might be resorted to. He also appointed Dr. Andrew McFarland to visit Massachusetts where the disease was raging, to carefully note and report all the facts he could ascertain regarding its causes, nature, treatment, &c. The executive committee of the State Agricultural Society convened at Bloomington, to take measures to secure the stock-growers of the State against its introduction. They indorsed the action of the governor, recommended that railroad, canal, and steamboat lines prohibit the introduction of all cattle from the east into the State, and appointed James N. Brown commissioner to accompany Dr. McFarland on his tour of investigation. The companies of transportation from the east at once seconded the suggestions of the executive committee, and for a time there was a complete embargo placed upon the introduction of eastern stock. No exhibitors from the east were allowed to show their stock at the annual fair and cattle show of the society. Both commissioners visited the infected districts in Massachusetts, and made full and satisfactory reports upon the disease. Congress was memorialized to establish quarantine laws applicable to the importation of stock into the United States. Meanwhile measures were so promptly taken in Massachusetts to check the spread of *pleuro pneumonia*, that all these proceedings in a State so far removed were useless. But they show the jealous care with which our best men watch the stock interest, and how important it is in public regard. Diseases somewhat similar in their symptoms, and fatal to a limited extent, appeared in several counties of the west at about this time, which created some alarm, but they proved of local character, and soon died out.

At present and prospective prices for beef, the supply from the west will not diminish, except so far as the Texas and Missouri importations are cut off. There is a gradual but widely-extended change going on in the husbandry of the west. Wheat and corn culture, to the comparative exclusion of other crops and other systems of farming, is dying out. In their place the sugar-cane, flax, hemp, and, to some extent, cotton, are being cultivated. An increasing portion of the grain will be consumed by the live stock of the country, for it has become well established in the minds of a majority of western farmers that one of the easiest ways of marketing grain is in the form of beef and beef cattle.

REMARKS ON THE HORSE,

IN REFERENCE TO THE PRINCIPLES OF FORM REQUIRED TO ADAPT HIM TO SPECIAL PURPOSES, NOTICES OF BREEDS, &c.

BY SANFORD HOWARD, OF BOSTON.

The horse is a native of the old continent only. Over a vast portion of that division of the globe, wherever man has risen above the savage state, the horse has been held as his servant. He was possessed by the earliest civilized nations, and has been, from time immemorial, propagated in a domestic state. He is still found in a state of wildness on the unpeopled wastes of Central

Asia; but naturalists are not agreed on the question whether, as there found, he is the representative of a type originally wild, or as the descendant of a tame stock left for a long time in uncontrolled liberty.

Although, in point of usefulness, the horse cannot claim superiority over some other domestic animals, he has ever been regarded with peculiar interest. To the human tribes who were first able to command his services, he must have been of immense importance in warlike adventures, from the power he conferred in attack and escape. But he has been prized for various properties; the beauty and gracefulness of his form, the nobleness of his demeanor, his strength and swiftness, have furnished a theme for poets from the days of Job.

The varieties of the horse, although presenting striking external differences, are included in one species in zoological arrangement; yet some of these varieties are of such antiquity that we have no knowledge of their origin. Different countries, according to their geographical position, soil, &c., have always, or within the historic period, possessed breeds of horses having certain peculiarities—those of the greatest bulk belonging to level and fertile districts, and those of smaller size to more elevated situations, where the herbage is less nutritive and the climate more severe. The contrast between the English or Flemish draught-horse of more than a ton weight, and the Shetland pony of less than two hundred pounds, excites our astonishment, and may suggest doubts in regard to the idea that both sprung from the same stock.

Considered in reference to utilitarian purposes, the horse may be called a machine. He performs certain actions corresponding to his shape and proportions. In opposition to this principle, it may be urged, perhaps, that horses of different shapes are sometimes distinguished for the same performances. Admitting the full force of the argument, it by no means invalidates the proposition. An imperfect engine, in reference to the principles of its construction, may be made to run at high speed by the application of steam enough. The animal machine is set in motion by what we call nervous energy or force. A large amount of this force may produce great results, even with an animal whose form is defective. But suppose the same amount of force had been applied to an animal constituted, in every respect, on true mechanical principles in reference to its movements: would not the result have corresponded to the perfection of its conformation? It may be safely assumed that, other things being equal, the best horse in the end is that having the truest form, considered in reference to the kind of action or labor required of him.

Horses are used for running or galloping, for trotting, and for slow or heavy draught at a walk. The first-mentioned action is that of the race-horse and hunter; the second, the roadster and coach horse; and the third, the draught or dray horse. In reference to these purposes a brief view will be taken of different breeds.

As already intimated, the horse is not a native of America. The colonists from various parts of Europe brought hither various stocks. The Spaniards brought horses from Spain, and from those thus introduced have sprung the half-wild stocks of Mexico and some South American countries. The German settlers of Pennsylvania introduced the heavy draught-horse of their fatherland, and it is still perpetuated. The French settlers of Canada brought with them horses from their respective districts, the descendants of which are still preserved, though probably somewhat deteriorated as to size from the original stock. The modern Norman or Percheron horse has been introduced into New Jersey and some other sections, but has not yet become numerous. The English and Scotch settlers of Canada West have introduced the Clydesdale and other breeds of the British draught-horse. The race-horse has been introduced and propagated to a considerable extent in various portions of the United States and the British provinces. But in describing breeds it will be proper to consider them chiefly in reference to the characters they present in the countries where they originated or have been long established.

According to the plan of classification which has been suggested, we may commence with the galloper, in which division the Arabian horse belongs and occupies a conspicuous position. This breed has for a very long period been remarkable for its peculiar properties. The conformation of the body gives great speed in the gallop combined with strength to carry weight on the back, and these properties, united with superior intelligence, have placed the Arab at the head of his species. We cannot tell for what length of time he has possessed these characters. There has been much speculation on the subject. Without offering an opinion as to the genealogy given by the Arabians of their favorite tribes of horses, there can be no question as to the great antiquity of some of them. There is evidence that horses have been bred on the Assyrian plains with little change of feature for thousands of years. The late researches among the ruins of ancient oriental cities, especially those of Nineveh and Babylon, have brought to light sculptured images of the horse, which might almost be taken as *fac similes* of the Arabian of the present day, although they may have been designed to represent the proud steeds of Sennacherib or Nebuchadnezzar. I allude to the sculptures obtained in the East by Layard and placed in the British museum, where I have examined them with great interest.

From descriptions given of ancient horses by the sacred writers, we are able to trace still further their affinity with the present Arabian. Job's sublime description of the war-horse would scarcely apply to an animal less noble than the Arab of the desert. The prophet Habakkuk, in warning the Jews of the dangers from the powerful forces with which the Chaldeans were about to assail them, says, "Their horses are swifter than the leopards, and more fierce than the evening wolves. * * * * Their horsemen shall fly as the eagle hasting to eat."

In size, the Arabian horse is what is commonly called small. Layard, who had the best opportunities to become acquainted with the purest tribes, states that their height is usually from fourteen to fourteen and a half hands, and that of great numbers which he saw in the desert, few reached the height of fifteen hands. His natural paces are the walk and gallop, and his performances under the saddle—in reference to speed and weight-carrying at long distances—are unrivalled. Layard was familiar with the best English racers and hunters, but gives a decided preference to the Arabs, as to their powers of endurance, although the English racer might have the advantage of speed at short distances.

It is doubtful whether any Arab horses of the best type have, until within a few years, found their way either to Britain or to the United States. Layard states that the so-called Arab horses which (previous to his eastern travels) he had seen in England and other parts of Europe were not at all to be compared, for symmetry and power, to the horses he found in the possession of the Shammar and Aneyza tribes, in Arabia. This opinion is supported by Mr. A. K. Richards, of Louisiana, who with his relative, Mr. Keene, made extensive travels in Arabia, a few years since, and succeeded in obtaining some very fine horses from the tribes mentioned. Mr. Keene has made various trials of these horses, and with very satisfactory results, in reference to the improvement of stock for the saddle, and in some respects for the turf. I had the pleasure of meeting Mr. Keene in Europe and hearing from him an account of the eastern horses. He stated that he rode many of them—some for very long journeys—and that he had never seen any other horses that were capable of doing what they did. The easy *lope* of the Arab horse would carry his rider from seventy-five to one hundred miles a day, for several days in succession. On Mr. Richards's farm, in Kentucky, I have had the pleasure of seeing the splendid imported Arabian stallion Fysol, and several imported mares, together with many very promising crosses of the Arabian with the best English racing blood.

The English racer, or so-called thorough-bred, in point of mere speed, stands

at the head of all horses. It is a breed of comparatively modern origin. From the term *thorough-bred* being applied to it, some persons have inferred that it is particularly pure in blood; but the history of the breed shows that such an idea is not well founded. The best authorities agree that the breed is of mixed origin. Whyte, in his *History of the British Turf,* says the so-called thorough-bred was derived from Turkish, Persian, Arab, Barb, and Spanish ancestors, with more or less of the ancient British blood, and that *crossing* made the modern racer what he is. Lawrence says: "Almost all the varieties of the southern horse have been introduced into this country [England]—Egyptian, Syrian, Persian, Grecian—and from such a medley of races has our English thorough-bred sprung."—(Page 67.)

The naturalist, C. H. Parry, in a paper published by the Bath Society many years ago, says: "In the female line of some of our most noted stallions, as, for example, Eclipse, I find a great many deficiencies or omissions. Now, the purity of those pedigrees is a most important point. It is considered by sportsmen as giving a high salable value even to untried horses. When, therefore, in this respect there is any deficiency, we may reasonably conclude that it arises from the intervention of some ignoble female whose rank it was prudent to bury in oblivion." He goes on to show the fallacy of the idea that the English racer is descended, as some have supposed, from the pure Arab. "The Arabs," he says, "have various breeds, of which that which they chiefly value is the Kochlani, whose genealogy, according to some, they trace two thousand years. These horses are so prized in their own country, that it would be very difficult to prove that all those which have been imported from thence were of this race, and not of some baser mixture. * * *

"Next in the pedigree of Eclipse comes the Barb, usually brought from Morocco, two to three thousand miles distant from the native soil of the Kochlani. That these are of the pure race we are obliged to take upon trust, and nothing is more improbable.

"Last among the known sires is the Turkish horse, some of which were war-horses or chargers. Of these, there are one or two crosses in the pedigree of Flying Childers, and in that of Eclipse from fifteen to twenty, with at least nine different and well-known Turkish stallions. Now it is agreed by all who have seen this breed that there is a most striking and essential difference between the frames of the Turkish and Arabian horses, the former being proportionally longer in the body and smaller in the legs than the latter. * * * *

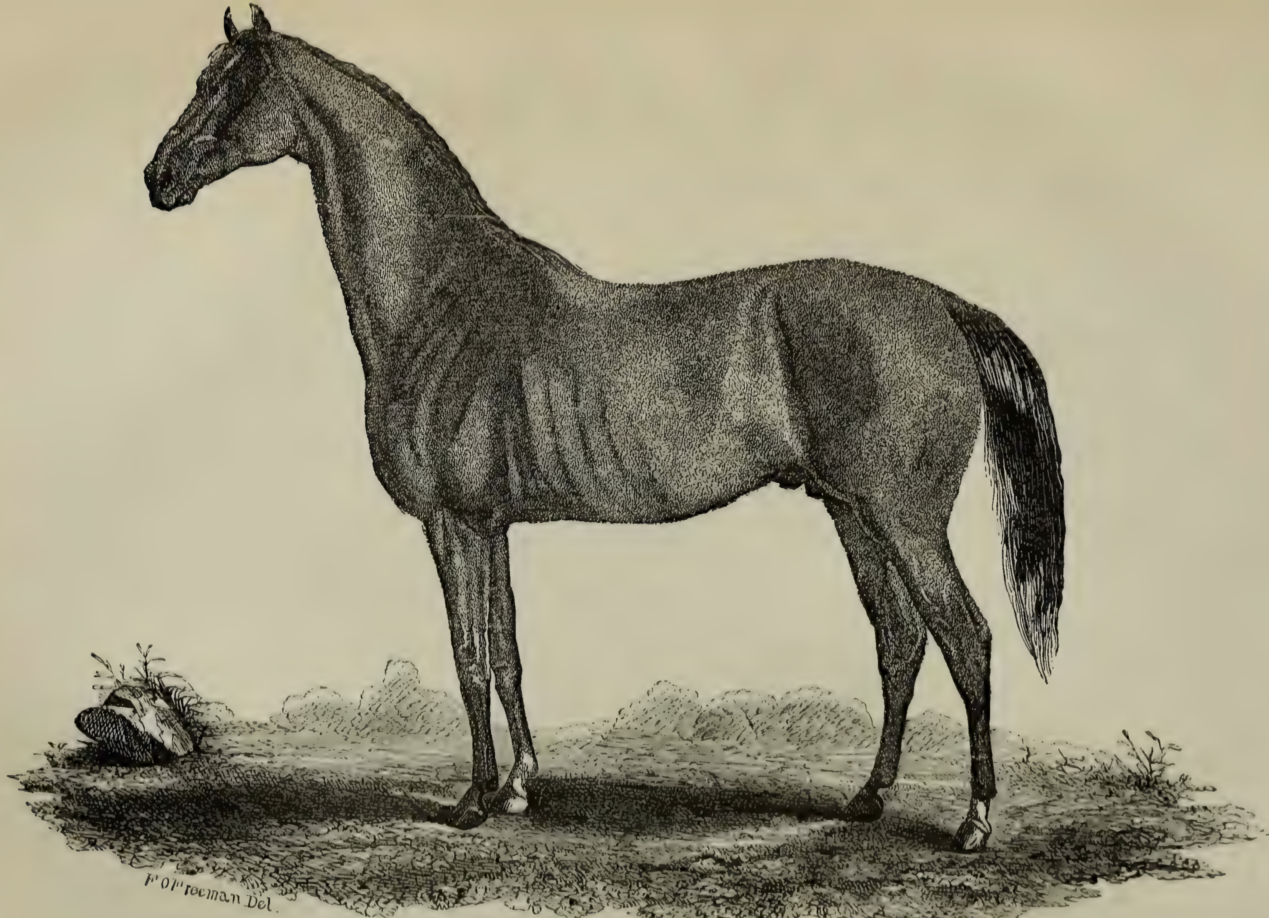
"In the pedigree of Diamond, an ancestor of Eclipse, there is a foreign horse of unknown extraction; and with regard to the royal mares procured by Charles the Second, it is not even presumed that it has been ascertained what they were.

"Such," he concludes, "is the origin of our boasted blood-horses, and such their real identity with the pure Kochlani or Arabian. On much better grounds the descendants of a ram exported from Lincolnshire, and mixing with the breed of Friesland, might be esteemed genuine Lincolns."

In regard to the difference between the Persian, Turkish and genuine Arab horses, it is well to add to the remarks of Dr. Parry that Layard considers it such that they cannot by any means be regarded as of the same breed, and that even the Barb does not approximate very closely to the true Arab. It is only necessary to cite one more authority in regard to the origin of the English race-horse.

"Stonehenge," the *nom de plume* of the author of *British Rural Sports,* (1856,) and late editor of the London *Field,* says in regard to the definition of "thorough bred" as applied to the horse:

"This is not quite so simple as is generally supposed, for though the thorough-bred horse is said to be of pure eastern blood, *this is not really the case* when traced back to the earliest times of which we have any account. In the pedigree of Eclipse there are names of no less than thirteen mares of unknown breed, and the same amount of impure blood, or nearly so, will be found in every horse of his date. * * * The only criterion, therefore, which will hold good as a definition, is the appearance in the *Stud Book,* where every horse and mare *considered* thorough-bred is registered, and by common consent this is accepted as the test of pure breeding."—[p. 281.]



Thoroughbred Stallion "BALROWNIE" *Foaled 1850.*
Imported, Sept. 1857, by Quincy A. Shaw, Esq., Boston, Mass.

"Even the purest thorough-breds are stained with some imperfections, and therefore it is only by comparison that the word (pure) is applicable to them. But since the thorough-bred horse, as he is called, has long been bred for *racing* purposes, and selections have been made with that view *alone*, it is reasonable to suppose that this breed is best for that purpose."—[p. 320.]

A very reasonable conclusion, it must be admitted. But it will be noticed on what an arbitrary rule the distinction of "thorough-bred" rests. It is not on purity of blood, for the whole race is admitted to be impure; but merely on the circumstance of registry in the Stud Book. Two horses might be of the same purity of blood, and yet because the ancestors of one are in the book and those of the other are not, the former *is* and the latter is *not* thorough-bred. But as the term has long been applied exclusively to the racer, it is now allowed because it serves to designate him from other varieties. The mixed origin of the variety shows itself in the varying tendency, to which an English writer refers in the remark that "though a powerful thorough-bred is the finest form of a horse, bring me them at random and I will engage that three out of four will be irredeemable rips."

Still the conclusion of Stonehenge, that the so-called thorough-bred is the best horse for racing purposes—and especially for short distances with light weights—will be admitted. It will be conceded, also, that an infusion of the blood of the racer has been the means of forming or improving other breeds, as will be shown as we proceed.

It is a subject which has been considerably discussed in England, whether the attempts to increase the speed of the racer, by giving him greater height, have not resulted in a loss of strength of constitution and ability to stand long-continued hard work. The height of the old stock seldom exceeded fifteen hands, and many were only fourteen to fourteen and a half. But they were close knit, muscular and hardy, quite a contrast to many of the modern racers. which are sixteen hands and upwards in height, though, as lately remarked by an English writer, many of them are tall only from their length of legs.

The hunter is required chiefly for galloping and jumping, but the work he is obliged to perform differs so much from that of the racer that a somewhat different structure is required. On this point Professor Low remarks: "The low fore and elevated hind quarters of the racer, which are suited to the power of rapid progression over a smooth surface, would, in the hunter, be inconsistent with safety, and the tendency to ewe neck, which in the short and violent gallop of the course is admissible, would, in the hunter, be inconsistent with sensitiveness to the rein." The hunter therefore should be higher in the fore-hand and more muscular in the neck than the racer. Youatt says: "The body of the hunter should be short and compact compared with that of the race-horse, that he may not in his gallop take too extended a stride. This would be a serious disadvantage in a long day and with a heavy rider, from the stress on the pasterns, and more so when going over a clayey poached ground. The compact short-strided horse will almost skim the surface while the feet of the longer-reached animal will sink deep, and he will wear himself out in his efforts to disengage himself." It may be remarked that so-called thorough-bred horses are sometimes used for hunting, but they are of a more compact and stouter form than ordinary racers. As hunters are not much used in America, we pass to the consideration of the roadster.

The proper paces of the roadster, as used in this country, and in harness everywhere, are the walk and trot. Here it is important to notice the different conformation required for trotting and running or galloping, and we may derive some useful ideas by studying the form of other animals. The hare, for instance, may be taken as a model for running and leaping. The muscular development of the hind quarter is great in proportion to the fore quarter. She moves, like the race-horse, by a succession of bounds, and she so poises her

body that her weight is carried chiefly on her hind legs, which also furnish the principal propulsive power. Her mechanical structure is admirable for this movement. But who would think of taking the hare as a model for a trotter? The celebrated English horse Eclipse, whose form and proportions were deemed by Lieutenant Bell and others nearly perfect for running, approximated to the hare-like model. He was taller at the rump than at the shoulder or withers. His hind quarter had great length and development in proportion to his fore quarter, a preponderance which is said to have given a wavering or sideways motion to his walk and trot, his fore-end being at the same time carried very near the ground. His speed was such that though he ran many races, he never found a competitor who would keep near enough to him to bring out his full powers.

Professor Low observes that the form of the racer corresponds to the conditions required, but that "his length is greater than consists with perfect symmetry, the power of speed having been sought for in greater degree than that of strength and endurance. His legs are longer and his trunk smaller than the eye indicates as strictly graceful. The length and depth of the hind quarters, a point essential to the power of making long strides, are extended to the degree of appearing disproportionate. The chest is narrow and the fore quarters light, a point likewise characteristic of speed. The neck is straight rather than gracefully arched, and the pasterns very long and generally oblique."

Such, in contrast with the roadster, are the points of the racer. For *trotting*, the machinery requires modification. In this gait, locomotion, instead of being effected mainly by a simultaneous spring of both hind legs, is the result of one fore leg and the hind leg of the opposite side working together. This action requires a more equal distribution of power between the four quarters, so that each division of the body may perform its share of labor. The comparatively light forehand, which is a merit in the racer, speed only being the object, would not answer here. An undue preponderance of the hind quarter would destroy the balance of power necessary to a square trot. A long back is favorable to the racer, when mere speed is the object, without regard to the weight to be carried, because from its greater flexibility it gives more play to the hind quarters; but a short back is more consistent with the work of the roadster, from the greater strength and firmer support it gives. The long pastern of the racer would be objectionable in the roadster, from its less strength and greater liability to give way under steady hard work. Obliquity of shoulder may be considered indispensable to easy and fast trotting, though it is of less importance in the racer, as some horses with upright shoulders run well.

The roadster is the description of horse the breeding and rearing of which is generally attended with the greatest profits in New England. Some of the reasons why the roadster is better fitted for this section may be glanced at. It is a maxim that the size of animals to be reared in any locality should be regulated by the soil and climate. Our soil is comparatively thin and our climate rather severe—better adapted to animals of small or medium size than to those of large size. We have already the stock for producing the best roadsters—horses of the weight of 950 to 1,000 pounds, and fourteen and a half to fifteen hands high, adapted to light carriages and quick driving. The class is well represented by what is called the Morgan horse, under which term it is intended to include the late Black Hawk, of Vermont, there being the most indubitable proof in my possession that his sire was Sherman Morgan. There is a great demand for horses of this character, and although they can be reared at a cheaper rate, they bring generally the highest prices. The distinguishing characteristics of these horses are neatness and compactness of form; hardiness of constitution, with general soundness of wind and limb; strong digestive organs, enabling them to live on little food; good action, making them fast travellers

particularly as "all-day" horses; a high degree of intelligence and spirit, constituting altogether an *economical* class of horses, both in reference to the cheapness of their support and their lasting powers; in a word, presenting, as said by Mr. R. L. Allen, in the first edition of his *American Agriculture,* "the beau ideal of the road horse."

These horses are also well adapted to such labor as most of our farmers require of horses, oxen being used here for the heaviest kind of farm work. In sections where oxen are not kept for labor, the farmer requires a heavier description of horse.

The principle to be observed in regard to the breeding of the roadster has already been indicated. It is that horses should be bred in reference to the work required of them, and that in order to attain the greatest perfection in reference to each class, *they must be bred on different models, and kept separate and distinct.* In saying this, the fact is not overlooked that it has been advised to resort exclusively to raising stallions for the production of roadsters, a position which will be noticed.

It has already been stated that the best roadsters or trotters were derived in part from the racer. The properties which have been obtained from the latter are nervous energy, spirit or courage, and elasticity of movement. In reference to this combination of blood, the remarks of the distinguished veterinarian and author, W. C. Spooner, are worthy of notice. He says: "We obtain from the thorough-bred horse the small head, lengthy [hind] quarters, powerful thighs, and extended stride; but it is from the Norfolk trotter, the old English hunter or hack—descendants to some extent of the ancient Spanish horse—that we derive the oblique shoulder, elevated withers, good forehand, safe walk, and fast trot, accompanied by a larger and wider frame, greater bone, and more powerful digestive organs than the blood horse generally possesses. When once these varied qualifications are combined, it is *a fact accomplished*—the means in our hands for continued excellence, by which we can impart to the next generation the requisite amount of breeding without that risk of weediness which so often attends the first cross."

To say what is the precise amount of racing blood required to make the best roadsters is obviously impracticable. There is, as has been intimated, a great difference in horses of the racing breed. Some possess in a higher degree than others the properties we desire in the roadster. Of course, we may have more of the blood of such an one without injury than of one of different character. But it may be laid down as a fact that a large majority of the best roadsters have been less than half-blood.

But in support of my own views a few English authorities will be cited. Lawrence, (1809,) speaking of the trotting of thorough-bred horses, says: "They soon become leg-weary, and their legs and feet are too delicate for the rude hammering of the speedy trot."—(Page 174.) * * * "Whilst established varieties are good and salable in the market, it is more advantageous to adhere to them than to run into random crosses. For example, racing blood is [was] the grand improver of all our saddle and coaching stock, and by a sort of tacit convention they have certain portions of it; more would do harm, by rendering the nag too delicate and leggy, and *spoiling his trot;* less would render him coarse, sluggish, and unfashionable. Thus I have generally found it preferable to put a hackney [roadster] mare to a good reputed hackney stallion, rather than to a racer. * * * You thus proceed safely and on already improved ground; if you have recourse to racing, carting, or rough, unimproved blood, you are losing time and going backwards."—(Pages 116—117.)

Stonehenge, to whom reference has already been made, says: "Although the thorough-bred horse is well fitted to compete with others in all cases where speed [in the gallop] is the chief point of trial—as in flat-racing, steeple-chasing, &c.—yet he is not so well qualified for some kinds of harness-work,

or for road-work of any kind, as the horse expressly bred for that purpose."—(Page 320.)

In reference to the amount of racing blood in trotters, this author says: "Generally speaking, they have been less than half-blood."—(Page 415.) He concedes that "no English horse can compete with the American trotters," (page 413,) which he regards as "very common-looking, generally of middle size, and with plain hind quarters, but have game looking heads, and legs and feet of iron; in this last point and in stoutness being unrivalled."—(Page 415.)

In regard to breeding trotters, this author says: "If these horses are desired to be bred, a trotting mare should be put to a trotting horse, like the Norfolk Phenomenon, * * * and the less [in addition to what this breed already has] of the pure eastern [racing] blood that is mixed with it, the better; and if a decided cross is wanted, it should be sought for in America. * * * The two breeds [racers and trotters] do not cross well, and they should be kept studiously separate; and the reason of this is the difference in their action."—(Pages 430—441.)

Allusion has been made to an English variety of roadsters, called the Norfolk trotters. The horse Norfolk Phenomenon, mentioned, belonged to this variety. They originated upwards of seventy years ago, in the county of Norfolk, England, and were derived from crosses of the so-called thorough-bred horse. They are still preserved, though probably less numerous than formerly, and are considered the best roadsters in the kingdom. At the show of the Yorkshire Agricultural Society, in 1858—a great show for horses—they took nearly every prize in the roadster class. I had the opportunity of giving them a very careful inspection, and found among them many excellent horses, their general model being similar to that of our best New England roadsters. An entire horse of this Norfolk breed, called Bellfounder, was brought to this country in 1822, and was kept several years by the late Colonel JAQUES, near Boston, and was afterwards kept on Long Island, where he died.

The coach-horse in England is ranked in a different class from the roadster. The distinction is a very proper one, and should be recognized here. The city coach-horse is not an animal subjected to much hardship; he is wanted rather for show than use—a few hours' moderate exercise on fair days constituting his chief duty. Animals of somewhat lofty appearance, handsome outline, good hair, and attractive color, are required. Their action should be showy, but need not be very fleet. Of course, I do not include under this head the *fast teams* which are kept for sport and amusement.

The most popular coach-horses in England are the Cleveland bays. The original stock to which this name was applied seems to have been a sort of smooth-legged, draught-horse, rather tall for the bulk, and of a bright-bay color, with dark mane, tail, and legs. They have been crossed with the race-horse; the present stock having more gracefulness of form, lighter action, and less bulk of body than the old, but retaining the color and height—sixteen hands or upwards, and a weight of 1,200 to 1,300 pounds. These horses are bred to a great extent in Yorkshire, there being a great demand for them for the London market. They have also of late been considerably sought after from the continent, from France, Belgium, &c. The breeders use the mares, and such stock as is of suitable age, but not marketable, to some extent in farm labor. They have more action than any other English horses of equal size.

The Cleveland bay has been introduced into this country. Within a few years several fine specimens have been taken to Virginia. I procured, in 1859, a very fine horse of this breed for Dr. J. R. Woods, of that State, and it is probable that a pretty extensive trial will be made in obtaining crosses of the breed, with the view of producing valuable coach-horses.

Many of our American coach-horses are a mixture, more or less, of the race-horse and mares of the draught character; but we have no particular variety of the coach-horse.

Another description of horse, which deserves mention here, might be called the omnibus horse. In all large cities there is much work for a horse of this kind. Where horse-railroads have taken the place of omnibuses, the same kind of horse is adapted to the work of drawing the cars. The Norman or Percheron horse of France is better fitted for this kind of work than any other I have seen. He has great muscular strength, remarkable robustness of constitution, soundness of limbs and feet, and, though not generally fleet, can travel with a load at a rate of speed which is surprising—eight to ten miles an hour with the heavy "diligences" on post-roads, or on horse-railroads, being frequently accomplished. The height of these horses is generally about fifteen hands, and their weight from eleven to twelve hundred pounds. These horses seem also well adapted to farm labor, and no good reason is apparent why they should not be a profitable stock for some portions of this country.

We come finally to the draught-horse. The proper places for this horse are the drays and heavy wagons and carts of cities, the heaviest kind of farm work, and all draft where the walk is the only gait required. The points of this kind of horse are in some respects opposite to those of horses required for quicker motion. It is a principle in mechanics that speed and power are opposed to each other, and the rule is applicable to the animal as well as to other machines. The leading characteristic of the draught-horse being strength, his legs should be short and his body large and muscular in proportion to his height. A very wide breast and wide base to the chest, which in the trotter would be a defect, because it would occasion a wavering motion to the gait, and a loss of time in preserving the balance of the body would be a merit in the draught-horse, as it would give greater weight nearer the ground, and brace the animal more against the jars and strains he must meet with in labor. An oblique shoulder, as already remarked, is indispensable in the trotter, whereas an upright shoulder and comparatively low fore-end are most favorable to the weight of the animal being thrown into the collar. Still as the low and upright shoulder are unfavorable to the reach and speedy and easy action of the fore leg, the point must not be carried to an extreme, lest the animal be deficient in speed in walking. It may be better to lose some power at a dead pull, if by so doing we obtain points which insure greater expedition in the performance of ordinary labor—a matter which will be further noticed in speaking of breeds of the draught-horse.

The leading breeds of British draught-horses are the old black cart breed, which from the earliest times has occupied the rich lands of Lincolnshire and other sections—the Suffolk and the Clydesdale. The former breed is of immense size, sometimes reaching the weight of 2,400 pounds, and furnishes the elephantine animals used in the drays and beer-wagons of the metropolis. For agricultural purposes, an animal of less size and quicker motion is generally preferred, and the Suffolk and Clydesdale are the favorites. Not having had the opportunity of making a thorough comparison of these breeds, I would not venture a decided opinion as to their relative merits. I met with the Suffolk chiefly at the shows of the royal agricultural, and the shows of other societies, and saw selected specimens on various farms; therefore can hardly judge of the average character of the breed. They are mostly of a sorrel or light chestnut color, sometimes with mane and tail lighter than the body; about sixteen hands high, generally very thick-set, which formerly occasioned the name of Punch or Suffolk Punch to be applied to them. They were formerly very low and thick in the shoulders, and possessed a wonderful power at a dead pull; but they have been bred, latterly, with a higher forehand and more obliquity of shoulder, points which have given them more activity. They seem to be generally good walkers, have pleasant, tractable tempers, and are not deficient in muscular strength.

Of the Clydesdale I saw more. They take their name from the vale of the

Clyde, but are bred extensively in several of the western counties of Scotland, and more or less in other sections of that country. I saw many of them in the principal breeding districts, at market fairs, and at agricultural shows—about two hundred of them at that of the Highland Society, and nearly as great a number at some local shows. Their color is chiefly bay and black, the former rather predominating. Their height may be put at sixteen hands, but in general they have less weight in proportion to their height than the English breeds before mentioned. Their weight ranges from 1,700 to upwards of 2,000 pounds. Many of them are very symmetrical—are higher in the withers, and particularly more oblique in the shoulders than the English, and walk with ease and rapidity, equalling in this gait any horses I have ever seen. They seem to be generally of good texture, are firm in muscle, sinewy and wiry, with short and wide shanks. They have good constitutions and are cheaply kept. They are seldom driven out of a walk. It is the custom of Scottish farmers to keep lighter kinds of horses for quick driving on the road.

The draught-horses of our country, as before remarked, were brought here to a great extent by immigrants from Germany. Many of the heavy horses used in our cities are descendants of these, bred in Pennsylvania and other sections where the stock has been disseminated. They have not generally the strength of limb and firmness of texture which we see in the Suffolks and Clydesdales, and I have no hesitation in saying that wherever horses of this description are bred, a cross with the latter, or an entire substitution of them for the so-called Dutch stock, would be a decided improvement. In some of our cities the supply of draught-horses has been, of late, obtained in part from Canada West, where, as before remarked, a cross of the Clydesdale prevails to some extent.

It will be seen that in the remarks which have been made horses are classified according to their uses—as gallopers or jumpers, trotters or walkers; that these are subdivided in reference to certain special purposes, as follows:

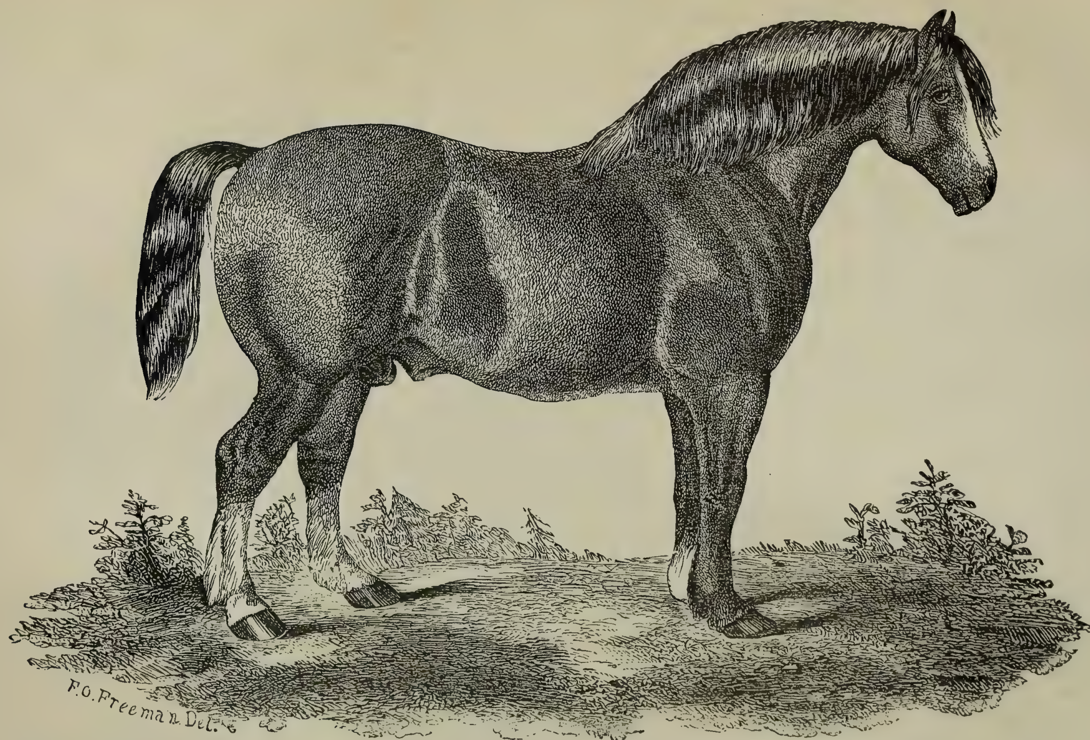
1. For long distances, with heavy weight on the back, at a galloping pace, the true Arab is the best model; for short distances with light weight, at the highest practicable rate of speed at the galloping pace, the English racer, or so-called thorough-bred, is preferable; for hunting, a more substantial horse, with greater weight and heavier forehand than the racer, is required.

2. Of trotters, for quick driving, in light vehicles, the roadster best meets the requirements; the best American horses of this description being probably superior to any in the world, certainly superior to the English. For city coach-horses, less speed and hardiness being needed, an animal of more size is called for; a purpose for which the Cleveland bay, or a mixture of the racer with some larger-sized stock, answers well. For omnibuses and horse-railroad cars, a more muscular horse, able to endure hardship, is preferable, the French Percheron being well adapted to the place.

3. Of horses the uses of which only require a walk, and where heavy burdens are to be drawn, a conformation more adapted to strength and less to speed is necessary. For heavy draught, some of the English and Scottish breeds are best; for farm work, where horses only are used, and for the drays, carts, &c., of cities, the Suffolk and Clydesdale breeds would be preferable to the horses now generally used for these purposes in this country.

In general, and especially for racers, roadsters, and draught-horses, it is better to keep the varieties distinct, breeding each in reference to an ideal or standard, combining the points which, according to mechanical principles and practical observation, denote the highest adaptation to their different purposes.

If experiments in crossing different breeds are made, they should be conducted with caution, and in such a manner as not to hazard a loss of the valuable properties already possessed by a breed.



Clydesdale Stallion "SIR WALTER SCOTT" *Eight years old.*

Owned by the Duke of Hamilton.

RAISING POULTRY AND EGGS FOR MARKET.

BY A NEW ENGLANDER.

A GREAT deal has been written in the few past years on the subject of advantageously breeding, keeping, and fattening poultry and producing eggs *for market.* Many suggestions and numerous theories have been presented to the public through the medium of books, and the press of our own and other countries upon this theme; and much of the information and advice thus promulgated has been of a visionary and impracticable character, though, at the same time, no inconsiderable amount of valuable information has thus been elicited from actual experiments made public regarding this agreeable and now highly important pursuit in rural life.

It is the object of the present paper to present the results of a long practical experience in this department in a familiar manner, and to offer for the benefit of the farmer, the breeder, and the amateur, certain facts and hints acquired by the writer through a long experience with, and a careful observation of, the habits, wants, and characteristics of domestic fowls, and to point at the probable profits attainable by breeding poultry and raising eggs for ordinary market purposes.

The *common* fowls of the country are at this time, of course, in great excess of numbers over any and all of the "fancy" breeds of late introduced among us from abroad.

Yet it is a noticeable fact that, by means of the importations of foreign blood made within the last dozen years, and especially through the introduction of the large Chinese variety (*Gallus giganteus*) amongst our farmers and poulterers since 1850, the distinctive characteristics of this race of birds are now very widely disseminated among the domestic fowls of America; and it would be unusual at the present day to meet with the flock in our farmyards or poultry-houses about the country where the marked features of the Chinese race of fowl are not to a greater or less extent visible.

That the mixing of this foreign blood with that of our own native races of domestic birds has proved of great advantage no one who has bred poultry extensively in the last twelve or fifteen years will deny; and whether we consider the item of increase in *size and weight,* at a given age, attainable with certainty through this crossing of stronger foreign blood upon our native breeds, or that of the well-decided advantage thus obtained in the enlargement and increase of weight and numbers of eggs obtained from the product of this crossing, the general gain by the process is most clearly in our favor. It is, therefore, but truthful to premise that the mixture of the Chinese blood with that of the common fowl of the country has proved of great benefit, and that the continuance of the practice will be found of corresponding advantage in raising poultry for the market, inasmuch as the product of the crossing matures much earlier than does the old native stock, thus giving, within a shorter period, more pounds of flesh in good season; while, for the producing of eggs, the half-bloods are known almost uniformly to commence laying at a much earlier age than the common fowl, thus affording us eggs abundantly at from four and a half to five and a half months old, and afterwards. For these reasons the writer fully agrees with a recent English author of reliability and

experience, that the introduction of the new races of fowls in late years "has resulted unquestionably in diffusing over the country greatly improved breeds of this interesting and useful kind of live stock; that more judicious modes of treatment than were formerly practiced have been made known; and that our markets certainly will by this means henceforth be more fully supplied with both eggs and fowls of a vastly superior quality."

Within the writer's experience, if, from this cross chickens are hatched in the months of February and early March, the male birds, properly cared for, will by July and August attain to a generous size for the table, and, if well fed during this period, they will average a dressed weight of five or six pounds each, or eleven pounds the pair, which, at the ordinary value of poultry in market in the months last named, will afford a very handsome profit upon their cost and keeping.

At about the period when the cocks are thus killed off, the pullets of this cross and age will begin to lay almost uniformly, and will continue to furnish eggs during the entire winter, coming in for sitters naturally in the months of February and March, when their litters will have been exhausted.

As to stock for *breeding* purposes, a selection is best made from the short-legged China (Shanghai) *male* birds, to be introduced to the common native female stock. From their chickens, *selected* birds only should be kept for future breeding, and the cross thus obtained are best *bred back* to the China male again, reserving from season to season only the short-limbed and well-shaped pullets from this crossing for subsequent use. In this way the better characteristics of the foreign blood are more uniformly retained, though it will be necessary constantly, as above recommended, each year to select the most promising fowls in shape, size, &c., for breeding purposes; for it is a well-known fact that all crosses deteriorate after the first one.

For obtaining the greatest amount of eggs, or for the production of the best average quantity of flesh, fowls should never be kept beyond the age of two years old. It is well settled that during the first year of her life a well-fed hen will lay more eggs than ever afterwards. From the end of her second year she begins to fail as a breeder, and chickens usually raised from *old* hen's eggs are never so vigorous, so healthy, or otherwise so promising as are those hatched from the eggs of young birds; that is to say, those from one to two years of age.

Male birds are in their prime only down to the end of the second year, and should not be kept for propagation beyond that period of life. For ordinary breeding purposes a vigorous young male bird will serve advantageously twelve or fifteen hens, the former number being preferable as a rule.

The males should be changed every season from one flock of females to another, and no male bird should be permitted to run with the same hens during more than a single season under any circumstances.

For the producing of eggs *only* no male bird is necessary to be kept with the laying hens; and during the season of moulting it will be found of advantage, decidedly, to separate the cocks from the pullets altogether. These hints are offered for the consideration of those who desire to breed fowls systematically and to the best advantage in moderate quantities. Where large numbers of birds are kept, it is not absolutely necessary that these recommendations should be altogether observed; but for the purposes of comparatively "good breeding," making no pretension to simply keeping up a purity of race, but rather for the every-day purposes of the farmer, who is satisfied with fair profits, and who breeds for ordinary market, the hints proposed will be found generally advantageous.

Late competent authority affirms that for breeding upon a large scale "only the best of both sexes should be selected, and these not too near akin."

"If it suits the fancy or object of the owner, his fowls may be of several breeds, without any risk of intermingling, the select breeding stocks being kept up by merely *changing the cocks every second year;* and not more than one cock to thirty hens need be kept for the general stock, as it is of no consequence whether all the eggs are impregnated or not." This has reference *not* to high breeding for the show rooms, but to the production only of poultry meat and eggs. The cost of fowl-keeping, first and last, if *all* the necessary food is purchased at ordinary market prices, will average not far from ten cents a head per month. With the run of the farm-yard, however, and only a moderate number of fowls, the cost is much less. In *large* numbers, say hundreds or thousands, the expense of keeping will reach the first-named estimate fully, if the birds are confined to limited quarters. This sum is fixed for the *food* dealt out only, the additional expense of care, and interest upon investments for cost of buildings and fixtures, land occupied, &c., is not included, and must depend, of course, upon the extent of the establishment, the taste and means of the poultry-keeper, &c.

Where fowls are kept for profit, and especially when large numbers are present, attention should be directed to saving the feathers taken from them, (if dressed for market,) and also the manure from the houses—no inconsiderable item of value in each year. Wilson, in his "British Farming," says that "where a hundred common fowls and a dozen geese or ducks are kept, the quantity and value of the manure produced by them, (but little inferior to guano,) if kept by itself and secured from the weather, will surprise those who have not made trial of the plan." Where five hundred or a thousand fowls or more are kept, the importance of this item will be worth remembering.

In raising poultry, whether the object be to produce chickens for the market, or to obtain a supply of eggs, the first principle to be observed is *absolute cleanliness* in and around the houses they occupy.

During the brief fattening process, if this plan be adopted at all, a range for the birds intended to be slaughtered is not necessary. On the contrary, for two or three weeks devoted to finally fitting fowls for the spit the more quiet they remain in their confinement (always supposing them to be kept cleanly and free from *vermin*) the better. For the London and Paris markets light even is also excluded from the fattening coops during the few weeks devoted to putting fowls in their best condition before killing. But this process is of doubtful utility, and the "cramming" method in vogue among certain breeders is generally deemed not only inhuman, but is undoubtedly not remunerative.

Fowls collected together in any number will get sick, and the query is often made, "How can they be cured?" If the fowl houses are kept thoroughly dry and *clean*, and the poultry free from *vermin*, there will be but little sickness among the chickens. When the case occurs, however, remove the bird that droops at once, knock it on the head, and bury it beneath the roots of the grape-vines. This will be a profitable and effectual riddance of *sick* fowls. Robert Scott Burn, in his "Lessons of My Farm," very rightfully asserts that "the cure of disease in ordinary fowls is not worth attempting, and the best way—mercilessly, or rather mercifully—is to devote the sick bird to the hands of the executioner. A fowl, under the slightest sickness, deteriorates so fast in condition that it is best to kill it at once, and thus put it out of misery, and avoid contamination to its neighbors. Far "better kill than attempt to cure." It costs more than it is worth, and where there are numbers to contend with the cure of fowl sickness is exceedingly difficult and uncertain. Such is my own experience, and such is my invariable disposal of sick chickens.

For both laying and breeding fowls a range or walk is a necessity to their comfort, health, and profitableness. Without this convenience, to a greater or less extent—and the more liberal the range the better—it is futile to attempt

to grow fowls to profit, and idle to expect them to produce eggs regularly. Good range, pure water, dry shelter, animal food, and entire freedom from filth, are all needful to promote high health and continuous prosperity in the poultry yard, but more or less *range* for laying fowls is the first essential to their well-doing. To afford this desirable accommodation, space is required; and where a considerable number of birds is kept upon a single farm, the room assigned to each lot should be as liberally accorded as possible, in order to prevent immediate sickness among the stock, for the crowding of a large number of fowls into single enclosures is certain to generate roup and other diseases.

Fowls must be colonized in small numbers to be bred profitably. This, in my experience, has proved a *sine qua non.* According to the "ancient laws of Wales," the intrinsic value of poultry in England one thousand years ago was very insignificant. "The worth of a goose," affirms this authority, at that period, "was one legal penny; of a gander, two legal pennies; of a brood goose, the value of her nest; of each gosling, half a penny, until it lays, and afterwards a legal penny; a hen was one penny in value; a cock two hens in value; every chicken was a sheaf of oats, or one farthing in value, until it roosts, and after that a half penny, until it shall lay or crow." This value was made up in the good *old* times, and contrasts singularly with the nominal value of certain fowls in the year of grace 1854–'55, for example, when cocks and hens of the then favorite breeds of imported Chinese stock commanded readily in England, as well as in the United States, such almost fabulous sums as five, ten, and even twenty guineas each! But neither the penny valuation of a thousand years ago, or the nominal pounds sterling value of the fancy breeds of 1854–'55, are of material consequence in this article, and we allude to the facts simply by way of comparison.

Of a more practical character are the estimates which follow. The London Board of Trade officially returns, as the number of *eggs* imported into England from France and Belgium for five years inclusive up to 1857, a yearly average of 147,342,219. For five years inclusive succeeding this period, that is, from 1858 to 1861, the average number annually imported was 163,581,140. In the year 1843 the number was but 70,515,931. In 1851 the number was 115,526,236, the amount of import duty paid during that year being £25,700, or about $128,000. In 1861 there were imported 203,313,310 eggs. At eight cents per dozen (the average wholesale market price realized) the money value of this single article for the year 1861 reached $1,355,542. This was for eggs alone, imported into England, and sold in ordinary market to first hands at wholesale prices, and had no reference, of course, to the large quantities raised by England upon her own soil, and consumed by her home population in the interior.

In the year 1856 the value of *poultry* imported into England was $221,400. The annual increase of importation since then, up to the year 1859, was about twenty-five per centum. In 1861 the whole value of eggs and poultry imported into England reached the extraordinary cash value of upwards of £385,000 sterling, or nearly $1,800,000. This has reference to the reported value of *marketed poultry only*, and includes no estimates at all of the large quantities grown and used at home, or the heavy sums paid for stock imported by breeders. During the last year (1861 to 1862) this vast valuation is very considerably increased, as the statistics clearly show.

In the vicinity of all large cities and towns fresh eggs are always in request, at the most remunerative prices. Every tiller of the soil possesses, more or less, facilities for feeding poultry economically, and has also the space upon his land to make them comfortable and thrifty. But some time must be given to looking after them daily, and a degree of *care* is requisite to keep them in "good heart," and to render them of profit in the end. Our Shorthorns and

Alderneys, our Suffolks and Chesters, our Southdowns and Cotswolds, all require care to keep them in fine condition. Why not, proportionately, so with our poultry, which, having reference to the comparative cost and product, pays with certainty so much greater a percentage of profit, year by year? In France every farmer has his chicken yard, and the amount of poultry and eggs consumed by, and exported from, that country is enormous. Monsieur de Lavergne, for example, estimates that the poultry of Great Britain for this year (1861–'62) is valued, in round numbers, at twenty millions francs, ($4,000,000,) while the total value of the two products—poultry and eggs—in France at the same period reaches rising two hundred millions of francs, ($40,000,000.) This last estimated product leaves a large margin for exportation from France over and above the requirements for home consumption, which surplus is sent over to England. These figures, relating to the quantities of poultry and eggs used and raised in France and England, are quoted, briefly, to afford an idea of the importance of this branch of rural economy in other countries, and thus to suggest its magnitude in our own.

In Paris and London, as in the large American cities also, the demand for early chickens (for the table) is always large and equally steady. Prime chickens command from nine to twelve dollars the dozen in American markets during the season. In England they bring from twelve to fifteen dollars per dozen. English farmers and poulterers, even at this day, are considered far behind either the French or Belgians in this branch of domestic economy. If our American farmers would pay more attention to this subject, and so manage as to put upon the market their poultry in good condition *early* in the season annually, (say in the months of May and June,) a more than commensurate profit would follow the slightly increased expenses and extra trouble of the earlier rearings, inasmuch as matured chickens will command a considerably higher price in the months of May and June than during July and August.

The most economical and advantageous mode of producing poultry and eggs for market has long been a mooted question; but favorable results depend principally upon the facilities at hand for multiplying fowls most readily *in quantities*. That poultry is, and can be, raised to profit in large numbers, is no longer problematical, the opinion of many modern writers upon this subject to the contrary notwithstanding. For instance: Monsieur De Sora, of France, who is the most extensive breeder of poultry in the known world, has been eminently successful in this business. His market for chickens and eggs is Paris, where tens of thousands of his *poulets* are annually disposed of for consumption in that city. But Monsieur De Sora has no use for setting hens. He raises all his chickens by artificial incubation, that is, by steam heat. His establishment is immense, and a large amount of capital is at present employed in the prosecution of his vocation. Yet he began with a few hundred dollars only a few years ago, and has progressed, until now he employs over a hundred hands constantly in the different departments of his colossal poultry house. Monsieur De Sora's product of eggs during the last year averaged almost 50,000 dozen *weekly*, which, with the sales made of his early chickens, yielded him $280,000 gross, in round numbers. His expenses, all told, were some $145,000, leaving him a profit of $135,000 for the year, or 675,000 francs. He feeds his stock upon animal flesh chopped up, varying the fare with vegetables and grains cooked. During the three months in the fall of the year he sends to the Paris market over one thousand dozen fattened capons, say from September to the end of November. His process of artificial incubation is being carried on continually, but the bulk of his chickens are produced during the late winter months. His net profits are now estimated at about fifty per centum upon his gross annual receipts of nearly three hundred thousand dollars! To our vision these immense figures appear very formidable, but De Sora's

poultry establishment is an enormous concern. During the year 1858 he wintered 100,000 birds, and in 1860 over 112,000 of the ordinary varieties, discarding, as he does, the Chinese breeds in their purity altogether. His plan of producing chickens is almost identical with that of the Egyptians, who, it is known, raise enormous quantities of fowls by artificial heat for market with constant success.

This mode is not convenient or feasible, however, in this country, as a rule. The above instance is quoted merely to show that fowls *can* be raised *in quantities* to advantage. With our farmers the plans of nature must be followed and adopted.

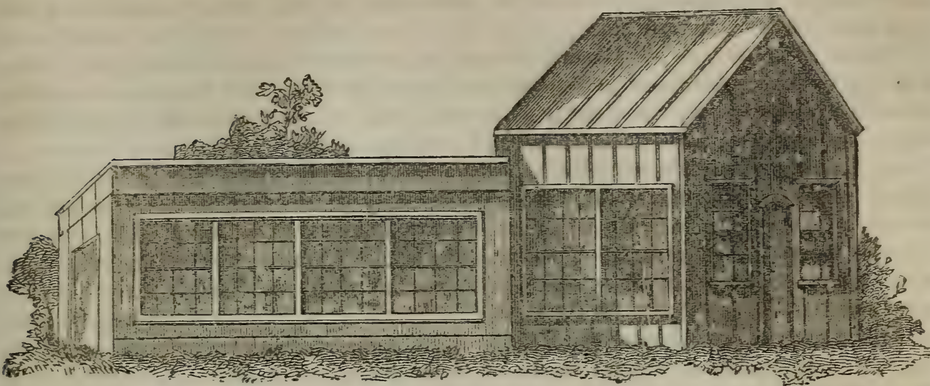
Eggs must be raised in the natural way with us, and chickens are best produced through the ordinary process which has been so long in vogue with us, to wit: the sitting of hens. A western journal estimated the value of eggs in the United States, in 1859, to be equivalent to one hundred and twenty-two millions of dollars, at eight cents per dozen. The New York Evening Post subsequently set down the value of eggs and poultry in the United States, in 1861, at the enormous sum of two hundred and sixty-five millions of dollars, reckoning at New York market rates for these products. The shipment of eggs from a single county in the State of Ohio, over the railroads eastward, in one month, was recently officially reported to be 115,200 dozen. From the State of Maine thousands of barrels of eggs are shipped monthly to the Boston and New York markets. These facts are cited as instances only. When we consider the immense numbers of eggs used by home consumption in every locality of the country, annually, and the vast quantities that are shipped from the interior to all other cities and large towns on the sea-coast, as well as the great supply of poultry that is daily furnished to the chief marts of the country, in addition to both the poultry and eggs which are consumed by all classes of Americans from their private domains, the calculations above noted are by no means unreasonable, though at first sight they appear almost fabulous.

In lesser establishments, such as seem to be sufficient for and to satisfy the taste of the occupants of most farms in the country where the raising of poultry is not made a specialty, the most indifferent accommodations are deemed ample for the comfort and welfare of the fowls ordinarily connected with the place. A simple lean-to, an out-building, a ricketty shed attached to the barn side, the barn itself—without other provision—in the estimation of many farmers, is considered "well enough" for the use and convenience of the chickens. But where one or two hundred fowls can just as well be profitably kept in a thrifty condition as a dozen or two can be neglected and starved, it is well that every farmer should look at this item of live stock, and bear in mind that, with ordinary care, (considering the necessary investment of capital and the trouble of its keeping,) *no* live stock will return him anything like so generous a percentage upon his money as will his too often neglected poultry.

As a rule, the poultry-house or houses are better placed, all things considered, with the aspect facing towards the west and southwest, with high rear and side walls upon the north and easterly sides for the hatching coops, to ward off the cold winds and effects of storms, more especially in our northern and eastern States. Shelter and warmth, in bad weather, are as requisite to the continuous prosperity of poultry as are cleanliness and food. During the severe winters experienced in our northern latitude, domestic fowls will neither lay nor be free from various diseases if exposed to rough weather or the chilling winds. A cheap and good style of house may be constructed with a partial glass front and end, facing as above indicated, the sash running from two feet above the

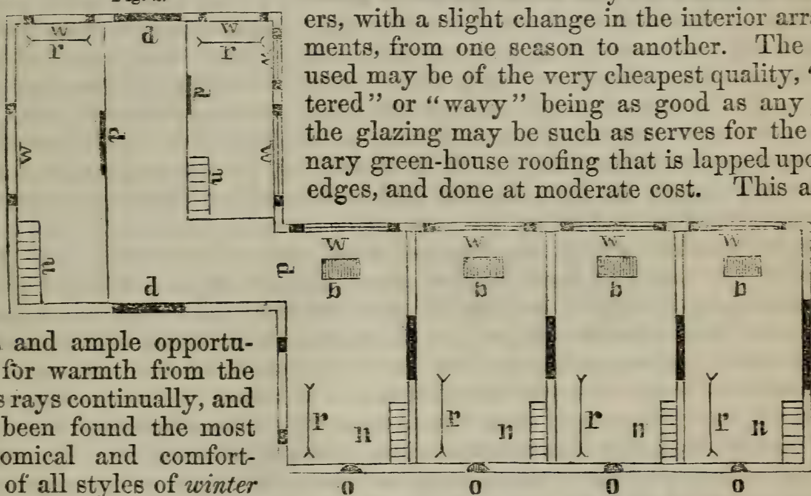
sill towards the peak, and upon the side towards the eaves, of any desired dimensions, upon the following plan:

Fig. 1.



Such a house has been in use for several years by the writer, and has been found to answer admirably for sitters as for layers, with a slight change in the interior arrangements, from one season to another. The glass used may be of the very cheapest quality, "blistered" or "wavy" being as good as any; and the glazing may be such as serves for the ordinary green-house roofing that is lapped upon the edges, and done at moderate cost. This affords light and ample opportunity for warmth from the sun's rays continually, and has been found the most economical and comfortable of all styles of *winter* poultry house. The wing may be of any length. Clay-beaten floors beneath the roosting places are economical, easily cleaned, and afford slight attractions for vermin. Half round roosts of large sized spruce poles are the most comfortable, and these should be movable to set upon cross-stilts not over two or three feet from the ground or floor. If these roosts are covered with strips of old woollen cloth, (tailor's list is best,) which, at nightfall, once a week, in warm weather, may be wet with spirits of turpentine or kerosene, the process will serve the double purpose of keeping the roosts free from vermin, and of freeing the bodies of the fowls from this same annoyance. Access to a gravelled walk or yard at the rear, in fine weather, is indispensible. A grass enclosure, if practicable, upon which fowls can range daily, is a desideratum in summer. In the rear of the above described house was allotted half an acre for this purpose. In the absence of these two last mentioned almost *necessities* to the high health of domestic fowls, fresh gravel and sand, broken shells, &c., and green food of some kind, as cabbage leaves, ruta-baga tops, turnip leaves, grass, or the like, should frequently be thrown within their reach, which they will devour with avidity, and which will greatly tend to their continual improvement. Old mortar or oyster shells, broken up, are excellent for variety, if accessible.

Fig. 2.



The house already described (figures 1 and 2) may be used for laying hens during the fall and winter, and for sitters in early spring time. From such a house the chickens, when strong enough, may be transferred to the *open* or "summer" coops mentioned hereafter, and shown in figures 3, 4, and 5. It must not be forgotten that thorough ventilation of the poultry house is a *sine qua non*. Pure air, and plenty of it, when not freezing cold, is as desirable to fowls as to man. A dust-bath, formed of screened coal or wood ashes, is a luxury for fowls confined in limited accommodations. The premises described should always be kept as cleanly as possible, and at least annually whitewashed upon the inside. The water furnished poultry should be pure, and if a stream runs through the enclosure all the better; if not, fresh water should be supplied them regularly, and the vessels from which they drink should never be suffered to stand in the sun at any season. Fowls drink a great deal daily. They should always have a plenty of water—fresh, clean, and cool. From long experience and observation the writer feels assured that no dumb creature better appreciates this provision for its health and comfort than does the domestic fowl.

In a recent address before the French Academie des Sciences at Paris, M. Genin declared that, after a careful study of three years upon the subject, and from repeated actual experiments, he could confidently state that the sex of eggs may be determined as follows: Eggs containing the male germ can be distinguished by their elongated form, and a partially raised or ringed surface around the small end of the shell, while those containing the female germ are comparatively smooth, and more equally of a size at both ends. The writer has tried many experiments upon this theory with fair success. Though not invariable, this simple rule, in the selection of eggs for sitting, is comparatively safe. The remarks thus far submitted have reference, in a general way, to the keeping of poultry upon an ordinary scale. With slight daily care and attention, as above hinted, any farmer can keep his hundred or two of fowls, which may readily be tended and provided for by the boys upon his estate, or even by the women of the household. From two hundred birds thus disposed he may obtain, annually, two thousand three hundred dozen of eggs, and, if inclined, at least fifteen hundred pounds of marketable chickens, before the close of August in each year. The product will pay him from four hundred and fifty to five hundred dollars *in money*, and leave him his original stock for the next year. His expenses will be not over two hundred to two hundred and fifty dollars, thus furnishing him with an equal sum of profit upon say two hundred fowls. Half this number will afford him half as much certain income, or nearly so. The cost of keeping fowls in such quantities as are alluded to would not exceed sixty-five cents per head, if all their food is purchased and corn be rated at seventy cents the bushel. With the run of the farm, of course, the expense would be lessened. This leaves a handsome profit upon the investment.

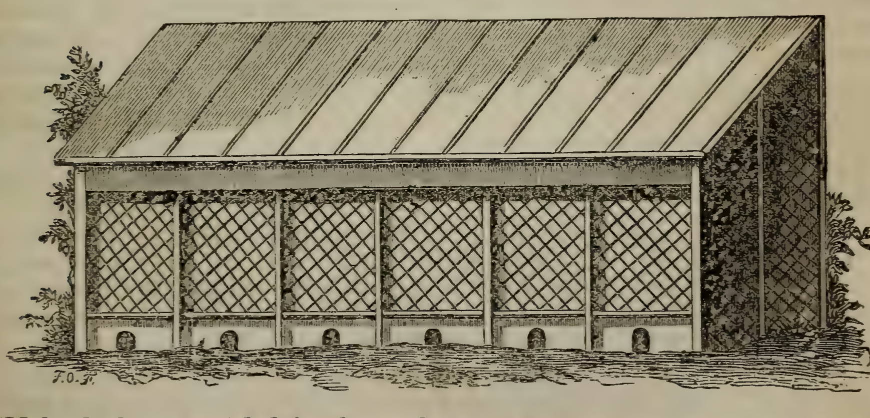
The calculation here made as to returns in eggs is set down at an annual yield of 140 eggs to each hen. This is fully up to the average under the best care and upon high feed. Some fowls will lay more than this number, but these are exceptions. From 130 to 140 eggs, yearly, is a generous supply, and I have never known any fowls except the Chinese, or the cross already described, that would accomplish more than this. The hen spoken of by some writers that "lays every day in the year" is a myth. By extra attention and care as to cleanliness and range in summer, with warm shelter and animal food in winter, fowls may be made to lay somewhat more liberally than is stated. But this forcing is done at too great a pecuniary cost, and also at the expense of their health, for they quickly become exhausted and worthless by the process Hens will lay only a given number of eggs *annually*, and it is only by hatching your chickens early in the spring that they mature in season to lay during the succeeding fall and winter. The secret of having hens to *lay in winter* lies not (as asserted by some) so much in feeding them peculiarly, at that

season, as in the simple fact of hatching the pullets in the right month of the year to bring them to maturity in the fall.

As to feed, *variety* is essential to the high condition and health of the birds. Fowls permitted to run at large, it will always be observed, are continually on the lookout for *change* in their diet. Insects, grasshoppers, worms, stray bits of animal and vegetable food, are devoured by them greedily at all times, and are sought for in every cranny and corner. Grains, bread crumbs, small bones, &c., are very grateful to them. So it is better to follow nature, in feeding them, as closely as possible.

For fattening fowls the best corn is the cheapest standard food in this country. Boiled rice and potatos and shorts or "middlings" of wheat are excellent. Small potatos and broken or even "damaged" rice, which can usually be readily obtained in any large city, serve an admirable purpose, and will be found economical for every-day feeding. Occasional allowances of barley or oats, or both, are highly advantageous to laying fowls. Sunflower seeds, which can be easily grown profusely along the entire range on both sides of all fences, without taking up room or causing any trouble save the original planting, are one of the very best alteratives and changes in diet that can be obtained, and fowls will devour this with a gusto always. In the writer's judgment, fowls should never be stinted in food. As much as they will eat without waste, and of the best, is deemed the most economical in the end; and this method will keep poultry always in good condition for the spit at brief notice, while laying fowls are thus continuously supplied with the material for affording the largest number of eggs regularly after they begin to lay. When the poultry is necessarily confined within enclosures, coarse meat, such as sheep's plucks, liver, the harslets of swine, pounded bones, &c., obtainable at the nearest slaughter-house at very trifling cost, should be given them as frequently as thrice a week. They will devour this food eagerly, and it supplies the place of that which they need and obtain when allowed to range at liberty. Where large quantities of fowls are kept, they must, of necessity, be confined, in colonies, to comparatively limited quarters, and artificial high feeding becomes necessary, while some sort of animal food is requisite to keep them laying steadily and in good condition.

Fig. 3.



Male chickens intended for the market may be kept together advantageously in considerable numbers in the same coops if brought up together from the outset. No pullets should ever be placed in these cages or yards. As fast as the birds reach the proper size and weight for killing they should be disposed of. For this particular purpose cock chickens are the most profitable, as they furnish more meat at a given age, and are of no account (in numbers) otherwise,

after they attain to a size suitable for the table. These male birds should be well fed *from the shell.* They will generally pay a large profit upon the investments, and may be killed at from three to six months old.

The plan of a fowl house already given (see Figs. 1 and 2) is such as the writer had in use for some years, in size, proportions, and appointments. Below is the design of houses adopted by him also for many years for *summer* use only, in which large numbers of chickens are annually raised for the market, and which are built at trifling cost.

Fig. 4.

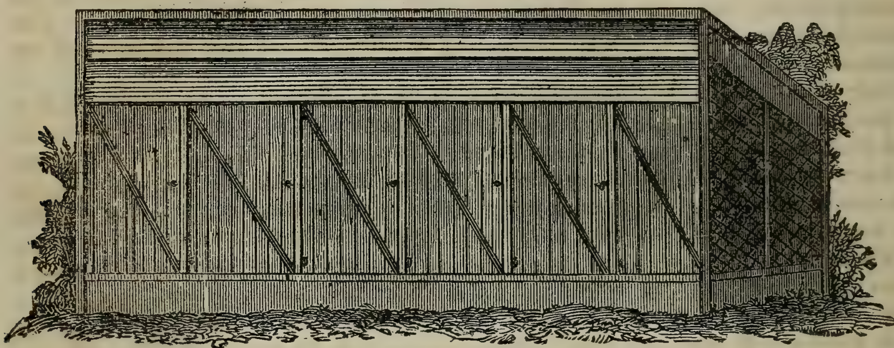
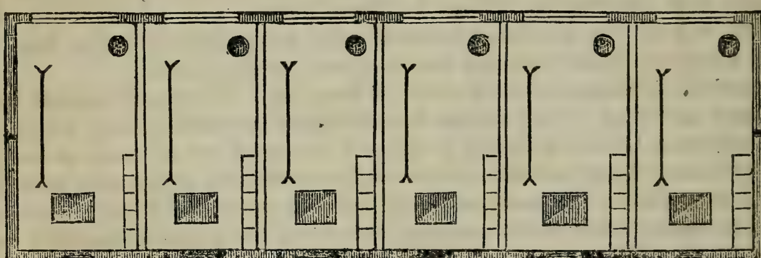


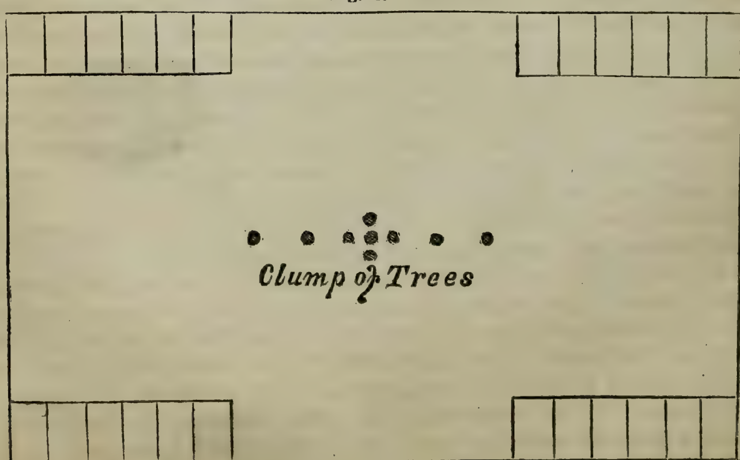
Fig. 5.



PLAN OF OPEN SUMMER CHICKEN COOPS.

Six of the compartments (or coops) are under one roof, and four different houses stand at the four angles of an oblong square of land half an acre in extent, thus:

Fig. 6.



This arrangement colonizes the different lots of chickens, with the mothers, from March or April to June and forward, and separates each from interference with the others. The land might be subdivided into four lots, but the expense of fencing would be considerable, of course, and has not been found necessary upon the writer's system of management. In each of the six *coops* indicated have been kept, from early March or April, twenty-five to thirty chickens, with two or three hens each, the aggregate, upon the half acre in the four *houses*, averaging, during the summer, 600 to 650 chickens, raised for and sold in market from June to August. A portion of the chickens, say one-fourth, are allowed to run into the whole lot (which is in grass) during three or four hours daily, when they are driven in, and another fourth part are released for exercise.

One house is usually devoted to male birds, exclusively. In the fall, a few of the finest of both sexes are selected to add to the next year's breeding stock, and the balance, seven or eight months old, are sold for consumption, at thirteen to fourteen cents per pound, paying a profit of 40 per centum at least, on cost, interest on investment, keep, and care. During the season, fine samples of birds for breeding purposes are sold in limited numbers, readily, at better rates, even.

The open or summer coops described are constructed of laths or paling-stuff upon all sides, and are protected by a shed roof, battened over the seams. The height of the front is eight feet, the rear six feet. The doors (to each subdivision) are also made of the same open or lattice-work or palings, and each *division* is twelve feet by seven. The six divisions make each *house* about forty feet by twelve. This is cheaply built, but is ample for all the purposes of raising the chickens to marketable condition, from the time they leave the hatching-house with the hen-mothers, as described.

The floors of the houses should never be *boarded.* The earth is much better, cheaper, and healthier. The roosts described are movable (being rested upon crotches) and may be set up in any portion of the coops where most convenient. If the floor is kept hard and dry, the sweepings from the cages may readily be saved and removed to the compost-heap twice a week or oftener. In any of the northern States, even, such coops as the above (for summer months) are far preferable to close houses of any kind, for the rearing of chickens. The boarding of the roofs and partially down the sides from the eaves to the lathing, (as shown in the engraving,) affords ample protection from the wet weather, and the young birds are thus early inured to the open air, and invariably do well with good feed and the daily run they have in the grass plat in front.

The winter laying and sitting house, described below, (figures 7 and 8,) may be also used for summer chicken-raising, if desired. The sashes in front can be taken out and lattice-work substituted; or the frames of the windows can be covered with two-inch mesh-wire screening, which is inexpensive and very durable. By this change the poultry-house is rendered cool and airy, which, for the "heated term," would be found too close and warm, for summer use, with the glass windows. This house should be carefully cleansed in the spring after the early chickens are removed to the open coops, which should be located, of course, on another part of the lot, and if in the whitewash-tub is thrown a pound or two of powdered sulphur, the wash will be greatly improved, so far as aiding to destroy any vermin present is concerned.

The lattice-coops will have already been cleansed, of course, for the reception of the young birds. The entire fixtures in these chicken-houses consists of a water-vessel for each, a feed-box, a low roost upon brackets, and a dust-box, two feet square, for ashes. Into this latter, it has been found a good plan to mix with the ashes a handful of powdered sulphur, occasionally, which helps to destroy vermin. In a few weeks from their entrance to these coops the chickens will follow the mothers to the low roosts, and I have never found any difficulty in keeping two or three hens with their broods in each of these com-

partments. Beneath the eaves, front and back, a board a foot wide forms a facia, beyond which (upon the lowest side) the roof overhangs about five inches, to carry off the rain. The whole arrangement is put together of rough boards and laths or fence-palings, and its cost is very moderate. I have had these in use, now, for twelve years, and have found them all that is needed for *summer* houses for market poultry.

Now, if six hundred chickens can be produced thus successfully upon a half-acre lot, no good reason naturally appears that *any* given number may not be similarly raised—for market purposes be it remembered—and kept, advantageously, from the early hatching period suggested, through the summer months, while the weather will commonly permit of their being left comparatively *in the open air.*

To attempt to *house* large numbers of fowls in close quarters during the severe winters at the north is not recommended. Thus, in order to raise chickens by hundreds or thousands, a great deal of space is necessary, as I have already aimed to show.

Now, when winter approaches and the weather gets too cold for comfort, upon the plan suggested, all the previous spring and early summer chickens will, from time to time, have matured and been disposed of, and only the fowls for winter laying and the next spring sitting remain on hand. The accommodations of the previous year are now used for the convenience of these birds, say from October to February, and the hatching of *their* broods, subsequently—their chickens, in turn, being transferred, in due time, to the open cages described.

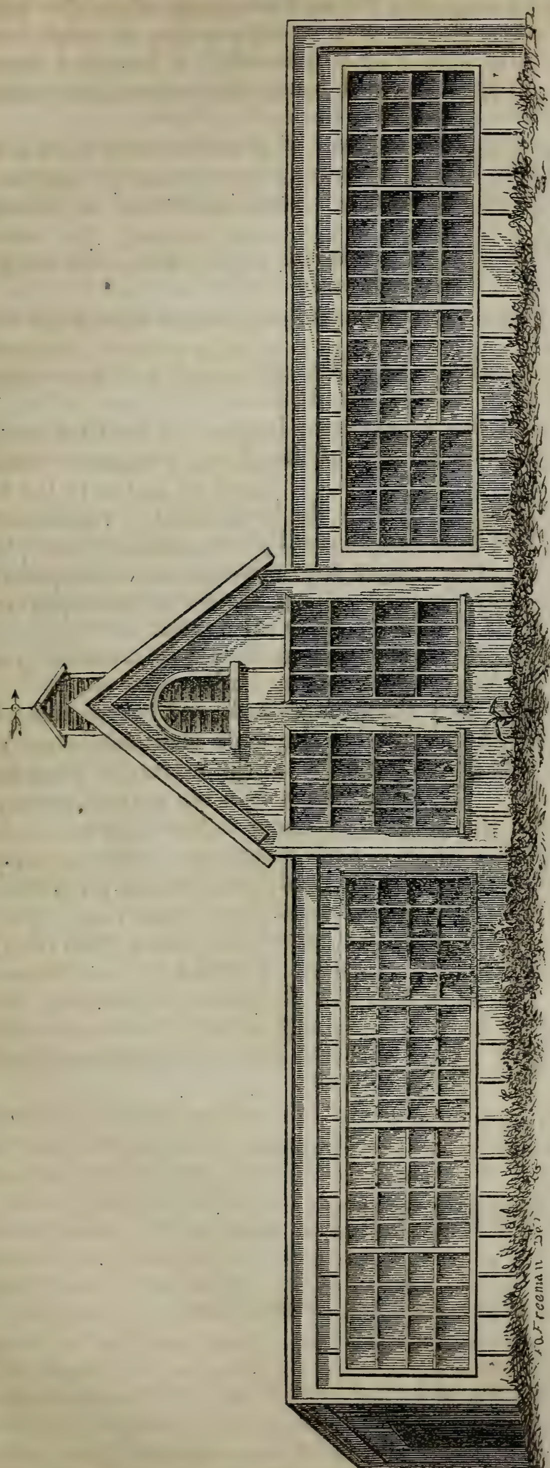
For the accommodation of the layers, and afterwards for the sitters in early spring-time, the plan on the following page is in use by the writer:

This house for sitters and layers, furnished with great simplicity, has been found ample for the purposes indicated. The building was erected ten years since, of rough No. 4 boards, set upright upon a two by four-inch joint frame-work, with four-inch corner-posts and centre-studs, and is battened upon the outside (over the seams) with three-inch paling-stuff. The roof was finished in the same manner, but shingling is better for this purpose. The corner-posts of the central portion of the building are sixteen feet high, the pitch is "one-third," and the dimensions of this part are seventeen by fifteen feet. The two wings (as shown in the elevation) are shed-roofed, falling back from the front, are twelve feet high, running down to seven and a half feet in rear, fifteen feet wide, and extend right and left from the outside of the central building, in each direction forty-five feet, making the whole house ninety-six feet long by fifteen feet in width, except the centre, which (for ornament in this instance) projects out two feet in front, as shown.

This house is surmounted by a cupola five feet square, with a vane, which adds to the comeliness of the premises, but need not be indulged in except to suit the taste of the builder. The central portion is *two* stories high, as is Fig. 1. The upper loft is floored over, and is useful for storing grains and vegetables, corn, &c., and can be turned to good account for cooking food for your fowls, if desired, or, by a proper contrivance, can be made the centre for a heating apparatus to add to the comfort of the birds (with pipes running right and left) during the coldest of weather. This loft is approached by a ladder from the rear, outside, through a door above the upper floor in the gable end. The building may be whitewashed upon the exterior, and made to look clean and respectable, or it can be clapboarded and painted to correspond with the residence or other farm buildings. To economize the cost it may be put up with boards and battenings simply, with the commonest glass sashes—tight, comfortable, and very serviceable, at moderate expense, and will last many years if properly *framed.* The sashes are upon a line in front, and are glazed in the manner already indicated in plan, Fig. 1. In this house about

fifty hens can be conveniently set at one time—say, in the ten apartments five each—who will not interfere with each other if properly cared for daily

Fig. 7



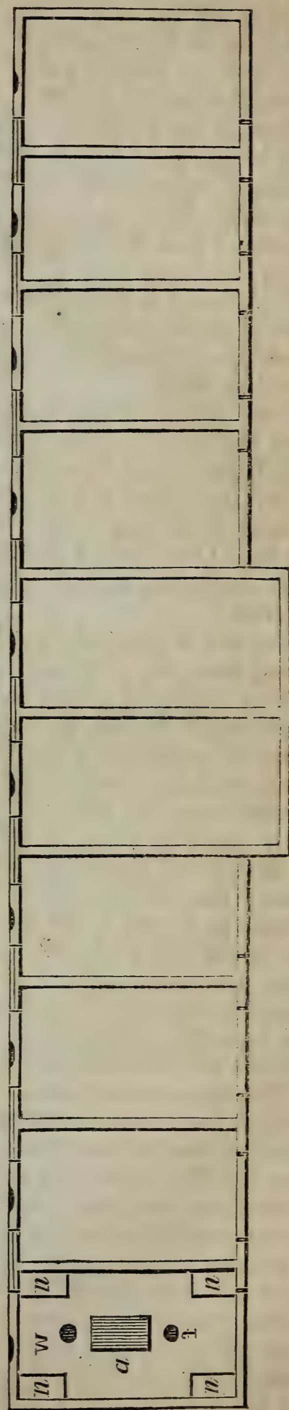


Fig. 8

During the late fall and winter months this building will accommodate, in its ten divisions, over a hundred laying hens comfortably.

During the early spring an average of a dozen eggs may be placed under your fifty sitters, and, with good luck, five hundred chickens may be produced, and this from the earliest broods. These may be removed in due time to the "open" houses, and another fifty hens may be placed upon the nests vacated by the first ones, who, with proper care, will bring out another five hundred chickens, more or less, say in six weeks after the earlier sittings.

It will be understood that upon the removal of the first broods the sitting boxes should be nicely cleansed before the second hens are placed upon the nests. By the time the second broods come off it will be the last of March or the first of April.

All the young stock may be safely transferred to the open houses by the beginning of May, where they can thenceforward be fed and cared for as previously directed, and fitted, like their predecessors of the year before, for the summer and fall market.

From the new stock the best samples of pullets are selected again, to add to the next year's breeding stock, as before; the old fowls (two years of age) are killed, the young cocks are all put in separate houses, to be used for the earliest maturing and largest chickens, and affairs go on during the fall as during the season previous.

By adopting the plans thus laid down, with the buildings and appointments herein suggested, a thousand chickens can be readily and profitably raised for the summer market annually, while ample conveniences are thus afforded, also, for at least one hundred laying hens during the winter months in the glazed house, (Figs. 7 and 8.) If the desire be to raise *more*, increased space must be accorded to your fowls, and more buildings should be erected.

It will not answer to increase the huddling of the birds under one roof. If the buildings are *smaller* even than those described, and more numerous, being scattered over acres, instead of confining the stock mentioned to half an acre, and to a building of the size given, it will be all the better for the general health of the birds undoubtedly. Crowding fowls into too narrow a space is one great cause of the fatalities attending the attempt to breed them.

Fresh air, light, cleanliness, varied fare, pure water, range, grass or occasional green and animal food, shelter from wet and raw winds, with plenty of gravel and ashes to roll themselves in, are all requisite to success.

With these advantages and fair attention, provision being made for the warmth and comfort of the laying hens in *winter*, chickens can be raised for the table and for market in any quantities, and to highly satisfactory profit; and eggs in abundance may also be had in any dry location within reasonable distance of the larger cities and towns of America, as has been proved through years of experience and of successful experiments.

POULTRY.

BY D. S. HEFFRON, OF UTICA, NEW YORK.

At this age of the world poultry and eggs have almost become a necessity; and from reliable data it seems probable that their annual production and consumption in the United States exceeds $15,000,000. The assertion is hence warranted, that the production and rearing of "domestic fowl" is not sufficiently appreciated, and that it should receive more encouragement. Poultry and eggs not only add one item of wealth to the country, but they contribute greatly to

the convenience and comfort of its citizens. Besides, they are produced, especially among agriculturists, with little care and expense; and by a little extra care it is reasonable to suppose that the amount now annually produced might be trebled.

The unusual interest, amounting almost to a mania, which existed in this country and in England a few years since on the subject of domestic poultry, although somewhat ludicrous in itself, had, on the whole, a beneficial influence, as it was the means of extensively disseminating several varieties of land and water fowls of superior excellence. The attention of the public was also directed to the improvement of our native stock of poultry, by judicious crosses, by better winter protection, and by a more liberal and more suitable quality of food.

In this article it is proposed to give a popular description of all the really good and distinct varieties of domestic fowls which are known in the United States; a few others more curious than useful will receive a passing notice; while the main object will be to give a few plain, practical directions for housing, breeding, and rearing domestic poultry. While the words used in this article should be such as can be easily understood by all, it may not be amiss to give the scientific names of the several genera to which our domestic birds belong.

The genus "*Gallus*" includes all our dunghill fowls, from the sprightly little Bantam to the lazy, enormous Shanghai. The jungles of Asia and the islands of the eastern archipelago still possess at least three wild native species of this genus. Each wild species is distinguished by its uniform size, form, and color; but in the domestic state we have every shade and mixture of color, from the pure white to an intense black. But we are not to suppose, merely from the great variety of colors among our domestic birds, that they have descended from a large number of wild species; for we find that other fowls have quite recently undergone great changes in color through the influence of domestication, as is illustrated in the Turkey and the Musk Duck. The largest fowls of the genus "Gallus" are—

The *Asiatic.*—Under this head are included all our very large fowls, such as poultry-books designate by the names of Chittagong, Cochin, Shanghai, and Brahma. Naturalists think these are merely sub-varieties of one species, and that they have descended from a large, coarse bird yet existing in the islands of Sumatra and Java, in a wild as well as domestic state, and known as the Great Malay fowl, or Kulm Cock. And it is supposed that the slight differences that exist among these sub-varieties mentioned are mainly due to the influence of domestication, being more or less affected by difference of climate, food, and frequent crosses.

The stock of our large fowls came from the southeastern part of Asia, in the vicinity of Shanghai; and hence the propriety of calling them all by the general name Shanghai, or Asiatic. The first were brought to this country about forty years ago, and their descendants gave size and character to the fowls of a part of eastern Pennsylvania, which have long been known in the New York market and elsewhere by the name of the "Bucks County Fowl." But numerous importations that were made about twelve years ago awakened a new interest for large fowls, and they have since spread all over the country.

Of these Asiatics, some have feathered shanks, some smooth, some dark, some yellow, and others greenish; some have long legs, others short; the most have single combs, while a few have combs more or less double. The plumage is of various colors; but the combination of colors that distinguishes the Brahma is generally preferred. All have short wings and tails; while the crow of the cock is remarkably prolonged, loud, and hoarse. The young chicks are slow in feathering, getting to be quite large before they are fully feathered. Early-hatched pullets, when well cared for, frequently commence laying when about five months old, and will continue to lay all winter. Their eggs are more or

less buff-colored. The weight of the mature cock bird is from ten to thirteen pounds; the hens are about two pounds lighter. They are peaceable and quiet, rambling but little if they have an abundance of food at hand. They are easily fenced against, both on account of size and shortness of wings. They are large feeders; have coarse-grained flesh, which becomes quite oily and rather rank-flavored in old birds; and by some they are thought to be more liable to disease than our common fowls. Our markets of late show a decided improvement in the size of the poultry offered for sale, owing to the influence of Asiatic blood.

The *Hamburg* is so named because the English in the seventeenth century, first received this fowl from the Hamburg merchants, who had previously imported it from some part of Turkey, or the East.

This beautiful family has numerous representatives in this country, as there are five distinct sub-varieties—the Silver Pencilled, Silver Spangled, Golden Pencilled, Golden Spangled, and Black Hamburg. The Silver Pencilled is commonly known by the name of Creole, or Bolton Gray. They all have certain points in common, as smooth heads, without a trace of a crest; low, broad, bright red, double combs, covered with small points, and terminating with a single long point turned upwards; roundish and rather large wattles, and tapering blue or slate-colored legs. The cocks have full-sickled tails, and an erect, sprightly carriage. The Hamburg hen has been known to lay 240 eggs in a year, a greater number than any other variety; but her eggs are quite small, weighing only from a little over an ounce to two ounces. The hens seldom sit. They are *all* small; the males weighing only from four to six pounds, and the hens from three to five. They are also quite tender, and rather difficult to raise, and should have drier and warmer apartments, especially in the northern States, than fowls usually receive. They are all impatient of restraint, and require a large range to do well. They are all beautiful, and as savory to the taste as pleasing to the eye.

The *Crested* or *Polish Fowl* has four sub-varieties—the Black, the White, the Golden Spangled, and the Silver Spangled. They are all distinguished by the crest or top-knot, which should be large, compact, and of good shape. The White and the Black have white caps. All have clean slate-colored legs or shanks. The hens of this family are good layers when young, seldom wanting to sit before three or four years old. The chickens are not as easily raised as the common fowl, and should be kept out of dews and showers. None bear confinement well, while all have white, tender flesh, of about medium quality. Weight, from four to six pounds. The Polish, like the Hamburg, should be considered as fancy birds, and not suitable for general use in the northern States. Both ought to do well south of Pennsylvania and Ohio.

The *Game Fowl* undoubtedly exceeds all other barnyard fowls in elegance of form and brilliancy of colors, while its "carriage is graceful and majestic." Its flesh is fine-grained, tender, and of superior quality. Some English authors enumerate over thirty sub-varieties of the game family. They are all small, the cock weighing from four to seven pounds, and the hens are correspondingly lighter. The body is rather long, quite round, tapering slightly towards the tail.

The Earl Derby game, formerly so highly prized in England, has pure white legs, while most other games have either yellow or dark-colored legs.

All games have great power of endurance, are hardy and easily raised, except, perhaps, the Sumatra and Malacca. The hens are fair layers, good sitters, and the most vigilant of mothers. They mature early, are restive when restrained, not laying in confinement as well as the Shanghai and the Spanish. For eggs, the table, and for crosses, the English Black-breasted Red stands prominent among games, being one of the largest, most hardy, and handsomest.

The *Dorking*, for all purposes, has long been considered the best domestic fowl in England; and of late years, since it has become better known, is growing in favor in this country. If the Dorking was as hardy and as easily raised as

the game, it would be the best fowl by far for general purposes. It has a plump, square body, with a remarkably full breast; short, stout, white legs and skin, and usually five toes upon each foot. There are both white and colored birds, the colored generally being considered the more hardy and a little the heavier. Their weight is from five to eight, and sometimes nine pounds.

Dorkings feather early, mature young, fatten easily, have a white, fine-grained and tender flesh, which is excelled in flavor only by the game fowl. Where crosses are received with favor, the Dorking is a fine fowl for the purpose, either to mate with the game or our common fowl.

The *White-faced Spanish* is the "gentleman's fowl" of England, where it is bred with great care. Its form is rather tall and symmetrical; its plumage a deep shiny black; legs, a bluish slate. Its distinguishing characteristic is its pure white face; which, with its large single serrated comb, and long, red, pendent wattles, make it a most attractive and ornamental fowl. The hens lay very large, pure white eggs, weighing from two and a half to three and a half ounces, and will lay more weight of eggs annually than any other fowl; while it is very rare for one to show any inclination to sit. Their weight is from five to seven pounds. They are sprightly, active, and stately in appearance, and bear confinement remarkably well. The chickens, which must be hatched under other hens, are hardy, easily raised, mature early, and commence laying when quite young. Though the plumage is black, the skin is white and flesh tender, of about a medium quality.

The Spanish has one marked drawback for common use, which is the large size of its comb and wattles, rendering it difficult to protect the delicate parts from the frost during the cold winters of the north, without better and warmer poultry-houses than are usually provided. To obviate this some breeders cut off their combs and wattles with a pair of sharp scissors, in the same manner that gamesters "dub" their game cocks for the pit.

The *Minorcas,* the *Andalusian,* and the *Leghorn* fowls have many characteristics in common with the Spanish, all having large combs and wattles, the same qualities as layers and non-incubators, are a little shorter in the legs, but all lack the beautiful white face of the Spanish.

Bantams are the smallest domestic fowls, frequently not exceeding sixteen ounces in weight; and are as proud, gay, and sprightly as they are diminutive. The pure white, pure black, and buff-colored, all having low double combs and smooth legs, are the only ones worth breeding, and breed uniformly like the parents in color. The feather-legged bantam is usually quite too large for a fancy bird.

The *Dominique* is the best fowl of common stock that we have, and is the only common fowl in the country that has enough distinct characteristics to entitle it to a name. These fowls are full medium in size, being but little less in weight than the Dorking, have full breasts, roundish plump bodies, double or single combs, and yellow legs. Their main plumage has a light gray ground color, while each feather is barred crosswise with a darker shade. They are frequently known by the name of "hawk-colored fowls." They are hardy, easily raised, retain their peculiarities with great tenacity, have yellow skins, a color preferred by many for a market fowl; and taking these fowls all in all, they are one of the best varieties for common use.

The *Creeper,* with very short legs; the *Rumpless,* a smallish variety without tails; the *Frizzled,* a homely, rough anomaly, with its feathers mainly turning forward; and the *Silk* fowl, a variety that is clothed with very soft, down-like feathers, destitute of a central stiff stem, are all sometimes met with at our agricultural fairs, but as they are all more curious than useful, are unworthy of further notice.

POULTRY FOR BREEDING.

Common barn-yard fowls, without extra feed, do not reach their full size before they are about eighteen months old. While growing, no quadruped makes a good breeder, and the same is true of poultry. It is the opinion of our best poultry-breeders that the cocks and hens used for breeding should be the best of their kind—of large size, well formed, perfectly healthy, the cocks not to be related to the hens, and none of the hens to be less than two years of age; from that age to five; while an early-hatched cockerel might do the next season if he should be mated with only four or five hens, an older bird is generally preferred. To insure fecundation in eggs for sitting, it is advised never to put more than from six to eight hens with the male bird, and of Shanghais and other very large fowls only about half as many. It is also better not to allow the cocks and hens kept for breeding to run together before the commencement of the breeding season.

To raise large fowls of any kind have the chickens hatched early in the season, feed often, and give a variety of nutritious food, until they get well started, and the more liberally the young are fed during the first season, if they always eat up all that is given them, the more satisfactory will be the result.

THE TURKEY.

The turkey is too well known to require a description. The name of its *genus* is *Meleagris*, of which there are but two species known—the *gallopavo*, which is the common wild or domestic kind, and the *occellata*, a wild species, native in Honduras, and remarkable for the great beauty of its plumage. Both are natives of America only. The turkey was first carried to England about three hundred years ago, but whether it had been domesticated here at a much earlier period we are not informed.

The wild turkey, from which all our domestics have descended, originally covered the whole territory from the Atlantic to the Pacific, and from about fifty degrees northern latitude to the Isthmus of Darien. In its wild state it has great uniformity in color, and why the domestication should have so affected it as to have changed its color, from its original type, to gray, blue, and even white, is left to physiologists to decide. Audubon says the wild turkey does not reach its full growth before it is three years old, which is also true of the domestic. This distinguished ornithologist gives the average weight of the wild hen turkey to be about nine pounds, and adds that "male turkeys differ more in their bulk and weight. From fifteen to eighteen pounds may be a fair estimate of their ordinary weight." He also states, apparently because it was so unusual, "I saw one offered for sale in the Louisville market that weighed thirty-six pounds."

Careful breeding greatly improves the size of the turkey, especially in its native country. The heaviest turkey that had been known in England previous to 1853 weighed, at death, thirty-two pounds. But that weight has been exceeded in this country by more than eight pounds. A few years since there was a male bird in Connecticut that weighed a little over forty pounds, and one of the same stock raised here, (Utica, New York,) when but eighteen months old, weighed forty pounds, live weight, and it had received no extra care, having been running at large with others until the day it was weighed. These weights have been nearly or quite equalled of late by several breeders. This result has been brought about by judicious crosses, and by reserving the best formed and heaviest birds of each year's raising for future breeding purposes. Experience also teaches conclusively that turkeys from two to five years of age are much better for breeding than young birds.

The person who aims to breed good turkeys should select from two to six of the best females that he can procure, from two to three years of age; then procure a male turkey, not less than two years of age, and not related to either of his hens. Breed from the same birds for three or four years. During this time save a few of the finest young hens for future breeding, then when the old ones are discarded, procure another male turkey not related to the young hens. Afterwards it will only be necessary to procure a male bird once in three or four years, but never mate him with any of his own young. As to color, the breeder must select according to his own taste. Size of the young depends as much upon the hens as the cock. By following this simple rule, with high feeding and good care when young, the breeder will most assuredly have the satisfaction of increasing the hardiness and strength of the young chicks and the size of his mature Christmas roasters.

The hen turkey possesses fair laying qualities, sits very steadily, and hatches in from twenty-eight to thirty days. As soon as the young poults are hatched, confine the turkey mother or hen in a large coop in a very dry, sunny place; never allow the young to run till after the dew is off, nor during rainy weather. After the first day feed as many as four or five times daily, for a week, with hard-boiled eggs, chopped very fine, and give nothing else, except it be a little cheese curd or a little stale bread rolled fine. Continue the egg or curd (or both will be better) daily for the next three weeks, feeding the broken bread, a little cracked wheat, and a little onion, garlic, or leek cut fine, not forgetting to feed often, and not overfeed at any time. After the poults are four weeks old, they can have soft feed to advantage, such as corn meal well scalded, scattering in occasionally a little clean sand. Scalded oat and barley meal is also good. Meal merely wetted up with cold water is poor feed for any and all kinds of young poultry. Young turkeys and other fowls are also benefited by any refuse pieces of fresh meat, cut very fine, and by a pan of sour milk to which they can resort as often as they wish.

THE GUINEA FOWL.

This bird (*Numidia meleagris*) called *pintado* by the Spanish, is a native of northern Africa, in parts of which it is still found wild in large numbers, as stated by Dr. Barth in his journal of his late travels in Africa. It is gregarious, and collects in large flocks on the low lands after the breeding season is past. The guinea fowl is a small, shy, active, noisy, and quarrelsome bird. There are several distinct colors, as the common or gray-spangled, the white, and the pied. Its flesh is quite dark when cooked, but tender and fine; if young, possessing much of the peculiar flavor that distinguishes wild game birds. The males and females look so nearly alike that it is difficult to distinguish the sexes, except by the noisy clamor of the hen as she utters the well-known cry, "come back," "come back." These birds retain the peculiarity common to most wild fowls, of mating by pairs; hence the necessity of having as many males in the flock as females, in order to have the eggs of all of the hens hatch. The hen lays from twelve to twenty eggs at a litter, and if not allowed to sit upon them will lay a second litter. The young chicks are rather tender, but are most active, beautiful, and interesting, being so perfectly covered with a thick zebra-striped down, that those not acquainted with them find it difficult to tell to what species of fowl they belong. These fowls are extremely watchful against danger, uttering a note of alarm, and placing themselves on the defensive the moment they detect the approach of a hawk, thus often saving the life of other kinds of barn-yard fowls. Their eggs hatch in from twenty-eight to thirty days, under common hens or Guineas. They are not liable to disease, and seem to be worthy of more general propagation than they have heretofore received. More care is required to raise the young chicks than with

the common fowl, as they are as sensitive to cold and wet as young turkeys; beside they require feeding almost as soon as out of the shell, and they should ever after be often supplied with fresh feed until large enough to range for themselves. The kinds of food suitable for the young turkey are also good for the Guinea chicks. Game and Bantam hens make excellent foster mothers for these chicks—much better than the Guinea hen herself, as they are more quiet and not as much disposed to stroll. Immediately after hatching, the hen should be cooped in some dry, sunny place, and if such a place can be secured among the cucumber or squash vines, the young chicks will help themselves to many a tit-bit, as well as help the gardener to keep the vines free from bugs.

THE DUCK, (*Anas.*)

The family of ducks is a very numerous one; but few of them are sufficiently domesticated to require a notice here. The varieties of most importance for domestic and ornamental uses are—

The Mallard Duck; the common Farm-yard Duck; the Aylesbury Duck; the Rouen Duck; the Musk Duck; the Black East India Duck; the Wood Duck; the Mandarin Duck.

The *Mallard Duck (Anas boschas)* is only interesting as being generally regarded as the progenitor of our common domestic duck, and of the Aylesbury and Rouen. It is found all over the northern part of both continents in its wild state, congregating during winter in vast flocks. It is bred in England and Ireland, in marshy districts in a partially reclaimed state, under the name of the Marsh Duck. It is small, hardy, prolific, dark gray, and is esteemed as a game bird.

The common *domestic duck* is as well known as any barn-yard fowl. They occur pure white, and of almost every mixture of gray and white, and it is not unusual to find them strikingly similar to the wild Mallard in shape and color, differing only in size. Their period of incubation is the same as that of the Mallard, being from twenty-eight to thirty days, depending upon the surrounding temperature at the time.

The *Aylesbury* is the largest, except the White Musk, and by far the best white duck. It is distinguished by its large size, its cream-white plumage, and its characteristic light yellow or cream-colored bill and orange legs. When well bred, adult Aylesbury ducks weigh from eight to ten pounds per pair, while the best specimens will reach twelve. A few years since R. C. McCormick, esq., of Jamaica, New York, sent the writer a pair that he had imported from Aylesbury, England, where he had selected them, that weighed twelve pounds when three years old. This duck derives its name from the town mentioned, where it has long been bred with great care for the London market. The Aylesbury is a prolific layer, it being not unusual for the duck to lay more than one hundred eggs, and in some instances one hundred and fifty, in a single season. The average weight of their eggs is about three ounces. Early-hatched birds sometimes lay in the fall. It is quiet and easily fattened, and fine for the table. The period of incubation of the Aylesbury and the Rouen is the same as the common duck.

The *Rouen Duck* has for a long time been as distinguished in France as is the Aylesbury in England. It is the largest, and, in some respects, the best duck of all our domestic varieties, though less beautiful in form than the Aylesbury. Its color is pleasing, closely resembling the wild Mallard. These ducks have broad, clumsily-built bodies, and when highly fattened they are very ungainly in their movements. They are remarkably quiet, easily fattened, and are most excellent layers of very large eggs, and have no equal for the table in the domestic family of ducks. The adult Rouen not unfrequently reaches from twelve to fifteen pounds per pair. They are emphatically a

"puddle-duck," seeming to care less for water exercise than most other varieties.

The Aylesbury and Rouen, though so much larger than the common duck, are supposed to be merely accidental outcrops, or more generally the result of liberal feeding and judicious crosses continued for a term of years. They hold the same relation to the common duck that the Bremen and Toulouse geese do to common geese, or that our best short-horn cattle do to the natives. And here the improved duck and goose should be allowed to teach us wisdom, as they so strikingly enforce the lesson that *good breeding* of domestic animals *improves* and *pays*.

The *Musk Duck*, sometimes improperly called Muscovy, is a native of Brazil, South America, where it is still found in large numbers in its wild state. It is occasionally and very properly called the Brazilian Duck, but no one can understand the propriety of calling it the Muscovy Duck, nor the Guinea Duck. In their wild state these ducks are very dark-colored, while with us they are changed to various mixtures of brown, black, and white, and sometimes a blending of brown and drab. The adult drake weighs from nine to ten pounds, while the duck rarely exceeds half his weight. They have long bodies, short legs, and a very clumsy appearance upon the ground, which they much prefer to large bodies of water. They like to perch upon the branches of a low tree, a fence, or a low building, especially during the night. They do not rank high for the table, even when young; and the males are perfect tyrants in the poultry yard. Time of incubation from thirty-four to thirty-six days.

The *Black East Indian* or *Buenos Ayrean Duck*, a native of both sections that contribute to its name, is not as well known among us as it deserves to be, though it is more remarkable for its beauty and excellent game flavor than for its size, being less in size than the Aylesbury. Metallic tints, varying with the light from green to a gilded purple, decorate their form of uniform velvet-black, their bills and feet being of the same hue. The female has the same general color as her mate, and is nearly as beautiful, while her disposition is far more amiable. These ducks require but common feeding to be fit for the table, their flesh being prized for its high game flavor.

The *Top-knot Duck* is of all colors, and varies much in size. The tuft seems to have been originally an accidental appendage, and there are few, if any, strains to be found that possess this peculiarity with any degree of uniformity. They are simply curious, with no brighter colors nor better points than the common duck.

The State of New York at its later agricultural shows has awarded premiums to a dark-colored strain of ducks called the *Black Cayuga*. It is claimed that this is a hybrid variety resulting from the pairing of a wild black duck and a common one. If so, (and we have never seen it questioned,) it cannot be worthy of extensive breeding, as it is an established rule that all such hybrids rapidly deteriorate when bred among themselves.

For amount of care and feed the Aylesbury and the Rouen yield the greatest profit; but if the breeder wishes to secure the most of the wild duck flavor, with beauty of plumage, he will find in the Black East Indian just what he wants. If he wishes to breed for fancy only, he should secure our native Wood or Summer Duck—a duck that for fine form, beauty, and brilliancy of plumage has but one known equal, which is the gorgeous Mandarin Duck, a costly native of the Celestial Empire.

DUCK BREEDING.

In the domestic state hens make the best of mothers for young ducks; but the eggs should be sprinkled or dipped in tepid water as often as once each week during her daily absence in hatching. When the eggs are placed under

the duck no moistening is required. As soon as the ducklings are all hatched the hen or duck should be cooped in a dry place, and the young furnished with a shallow pan of soft water, which should be often renewed. No food is better adapted to the health of the young for the first ten days than oatmeal boiled and cooled, or, in default of this, give corn meal prepared in the same way. When the pudding is given, it is well to add a few lettuce leaves. Bread crumbs or any refuse from the table is highly relished by the young. Nothing makes a more savory supper for the little gourmands than to take a spade and turn up some soil filled with earth worms. They soon learn the use of the spade, and will follow quite a distance to get such a supper. Marshy places along small streams, if free from injurious vermin, furnish so many beetles and small shell-fish that they make excellent places to raise ducks, frequently reducing the expense by more than one-half. Ducks can be successfully raised in any poultry yard, but require more care; and the breeding is attended with more expense in a yard without running water than where it has such a convenience. To raise large and superior ducks, the males should not be related to the females, nor the females exceed two or three to each male. After hatching, feed often and largely of nutritious food, keeping the young shut in their pens till after the dews are off, and during cold storms and heavy showers.

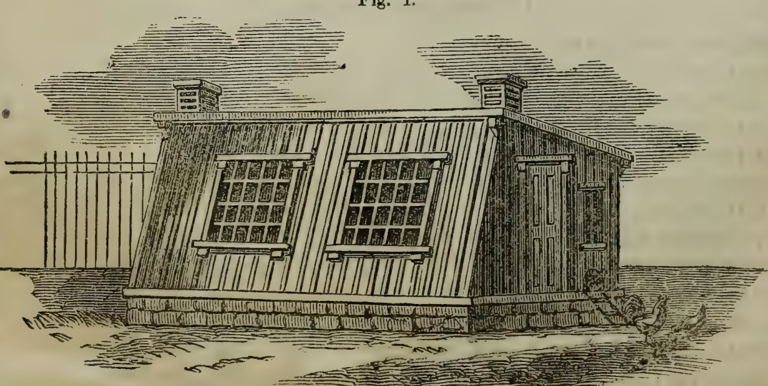
POULTRY HOUSES.

No one should commence keeping poultry without having some kind of a poultry house. It may be cheap or expensive, plain or ornamental, just as the taste or economy of the owner shall dictate; but it should be of sufficient size, warm in winter and cool in summer, always dry, well ventilated, and so conveniently arranged as to be easily kept neat and clean.

Barn-yard fowls, turkeys, geese, and ducks should each have their respective houses, suitably adapted to the peculiar wants of the kind of birds for which provision is to be made. Before the house is erected, however, a suitable site is to be selected for the poultry yard, for few families in village or country are so situated that they can profitably keep any considerable number of fowls without a yard, where they can be conveniently restrained from doing damage to the garden or field, or from annoying other persons. The best of all soils for such a purpose is a gravel or sandy soil with a porous subsoil. If inclining to the south or east, all the better. If the soil is clayey, or retentive of moisture from other causes, it should be well drained. The size may, of course, vary with the number of fowls to be kept; but it is very desirable to have a large grass plat at one end.

POULTRY HOUSE.

Fig. 1.

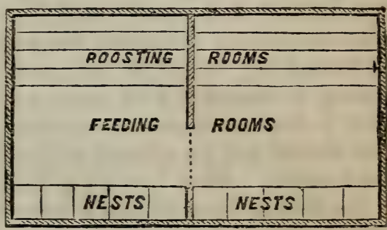


This cut represents a cheap, neat, and convenient house which we have copied, with slight alterations, from Tucker's Annual of Rural Affairs. It

may be varied in length according to the number of fowls to be kept. If built of the size indicated in the ground plan, (10x16,) it will afford ample accommodations for forty fowls; and if sufficient care were used to keep it clean, it would not be overstocked with fifty. Experience teaches that it is unsafe to house in one room more than fifty fowls at the same time; and with that number the ventilators should be open the full size during all mild weather, and only partially closed, by valves, during the coldest weather. Poultry houses should always be whitewashed fall and spring.

GROUND PLAN.

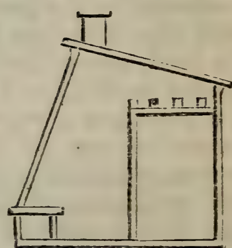
Fig. 2.



The ground plan, cross-section, and elevation exhibit the various parts so clearly that any mechanic can easily erect such a building. The front should face the south or southeast. It would be an improvement to stud the building all round with three-inch studs, and to line it with inch matched stuff. It should also be covered with sound, matched boards, and battened. The spaces between the studs should be filled in with dry tan; and it would add greatly to its warmth to make the roof double also, and fill as at the sides. The floor should be ten or twelve inches higher than the earth on the outside of the building, and the best material of which to make it is a mixture of sand and gravel, pounded down very firmly. Plant deciduous trees thickly about the house to keep it cool in summer. Perches for the Shanghai and Dorking should not be over two or three feet high; for Spanish, about four feet; and for Games and Hamburgs, five feet high would not be too much.

CROSS-SECTION.

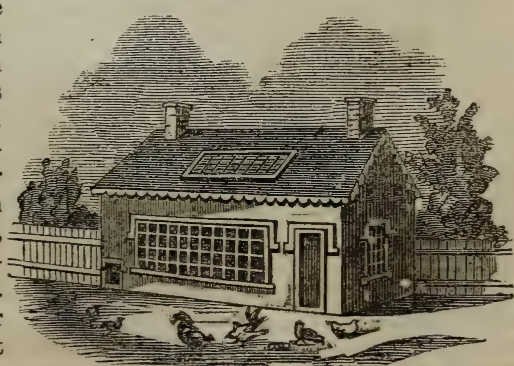
Fig. 3.



Every poultry house should be supplied with a "dusting-bath," which is a low box partly filled with dry wood ashes, mixed with a little dry sand. It should also have a second box containing old dry lime-mortar, calcined bones, pounded fresh bones or oyster shells, and a portion of dry, fine gravel. A water-tank of some kind is also one of the essentials, for the poultry need fresh water daily.

FINE POULTRY HOUSE.

Fig. 4.



Those desiring a better house than figure 1, may be pleased with figure 4. Let the front face as in figure 1. A house built after this plan, eight feet wide, thirteen long, with nine-feet posts, will accommodate thirty fowls, (enough for any family,) and it will have room enough for a dove-cot in one end, if desired, to which one gable window will furnish sufficient light. The nest-boxes may be placed over the feeding-boxes, two to three feet from the floor, as may be desired.

A tight matched floor should be laid about six feet above the lower floor. The roosting-poles should be placed crosswise of the gable, and near the stairway, commencing at the bottom next the stairway, the first about eighteen inches from the floor, the second about twelve inches higher and eighteen inches distant, and so on to the top. The loft should be cleaned daily, or have a daily sprinkling of dry black muck, or disintegrated burnt clay, or ground plaster; the whole to be removed frequently, and carefully put into barrels or boxes under cover, for the future use of the farm or garden. A door should be made in the rear side of the dove-box for its frequent cleaning. A trap-door may be made over the back end of the entry, to be reached by a perpendicular round ladder, to get to the dove-box.

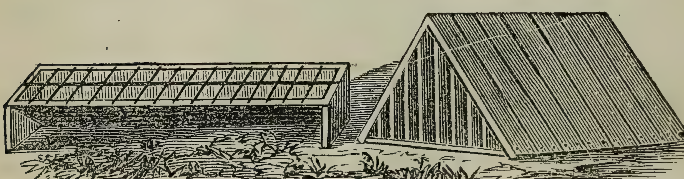
AQUATIC FOWL HOUSE.

Fig. 5.

This house (figure 5,) may be built where it will be convenient, and of such size as may be required.

POULTRY-COOP.—FEEDING-TROUGH.

Figs. 6 and 7.



The poultry-coop (figure 6) should be at least two feet high, and from two to three feet deep for common fowls, and may easily be made large enough for turkeys. Board up the rear end tightly, put a floor of boards in the back part of the coop, large enough for the hen to brood her young upon, nail a few slats in front, and the coop is finished. It is desirable, however, to add a wide board in front, as long as the width of the coop, to feed upon by day, and to turn up at night to protect the young against rats, cats, &c., and to remain in the morning until the dew is off the grass.

This feeding-trough (figure 7) is very cheap and convenient. It is made by nailing together the edges of two pieces of boards, one seven and the other eight inches wide, in the form of two sides of a triangle, and then finish by nailing on the end pieces, which should be about eight inches wide and one foot in length. To keep the fowls from getting into the trough with their feet, put a grate over the top, made by nailing cross slats to two or three strips running lengthwise.

THE PEA-FOWL.

The common pea-fowl (*Pavo cristatus*) has been known from the earliest dates of profane history. It is a large, graceful, and remarkably beautiful and showy bird, but its voice is loud, harsh, and disagreeable, while its disposition is often vicious, and its appetite so voracious as to render it an unfit companion for the fruit, the vegetable, or the flower garden. A few years since John Giles, esq., of Connecticut, imported from England a fine pair of the Japan pea-fowl. This variety is not quite as large as the common kind, but the male bird is darker and even more beautiful in color, while the female is lighter colored than the common and less comely in color. The common has twenty-four feathers in its crest, while the Japanese has many more in number, and of greater length.

The pea-hen lays but from six to seven eggs at a litter, rarely commencing before she is two years old. The chicks are very tender, and require the best of treatment when young, until at least two months old, while old birds are very hardy and long lived. At six to eight months old they are fine for the table; and before the turkey was known in England and on the continent a splendid banquet would have been considered deficient without the presence of this "dainty dish." To those who have large lawns, and can give this bird a wide range, it is one of the most ornamental of fowls, while no one with small grounds should undertake to keep it at all, unless in a tight, high enclosure covered with wire netting. Their eggs may be hatched under common hens or turkeys; a Shanghai hen makes a good substitute for the pea-hen. She should be cooped until the young chicks are about six weeks old, and the young should be fed very often, and with similar feed to that given to turkeys.

AQUATIC FOWLS.

The family of swimmers called *Natatores* is a very numerous tribe of birds' of which we know little, for only a few varieties have been fully domesticated amongst us, while some others have had their wild natures partially overcome. Among water birds, none, in its own element, equals, in stately elegance and graceful carriage, the noble

SWAN, (*Cygnus.*)

Of these there are several species that have long been known, and at least two of them quite successfully bred, yet none are fully domesticated, for none can be trusted without being pinioned. The largest and best-known variety, called the *mute* or tame swan, weighs from twenty-five to twenty-eight pounds; has a pure white plumage; dusky or black legs and feet; while on the upper part of the bill, next the head, there is a tuberculous knob, which, with the basal half, is nearly black, and the other half of the bill is an orange red.

But few swans are bred in this country, both on account of their high price and their requirements, for they cannot be kept successfully without a pond and a constant supply of pure water. They are also very cruel to other water birds. In the fall of 1854 a large number of the common mute swan and several black ones, the latter natives of Australia, might have been seen in the extensive poultry yards of John Giles, of South Woodstock, Connecticut; but the old white swans killed so many fine geese and ducks, and some of the black swans also, that the owner was obliged to part with them all to save his other pets. Hence the swan-pond should be occupied only by these birds, or possibly a variety of small sprightly ducks in addition, such as the Mallard, or the Wood duck. The cygnets, or young swans, are said to be excellent for the table. The race is known to be very long-lived.

THE GOOSE, (*Anser.*)

We have eight sub-varieties of geese that are more or less disseminated among us, which are generally supposed to have descended from three distinct wild species.

The *gray-legged goose*, (*Anser ferus*,) which is still found wild in the north of Europe, is the supposed ancestor of three distinct strains, viz: the common gray or white goose, the Bremen, and the Toulouse.

The most common goose of the country has long been domesticated both in England and on the continent; was an early attendant of our fathers to their new homes, and is known as the common gray or white goose, the males often having white plumage and the females gray, while in others these colors are variously mingled. These geese are easily raised, hardy, and profitable; but for want of care in feeding the young, and by long breeding-in, they are much reduced in size, quality of flesh, and in strength of constitution. These qualities might be restored by judicious crosses and liberal feeding during growth.

The *Bremen* is a large, pure white goose, with brick-red legs and bill. Our domesticated Bremen were first brought to this country from Bremen, in Holland, by Colonel Samuel Jaques, of Massachusetts, in 1821. In England they are called Embden, from a town of the same name in Holland, where theirs were first obtained. They are said to be extensively bred in Germany and Prussia, and probably Austria. These geese are very large, weighing from twenty-two to twenty-six pounds, live weight, and occasionally full thirty pounds when in high flesh, as seen at exhibitions; and though so large, they are well proportioned, hardy, healthful, and very showy. They are quiet and peaceable, and take on flesh very rapidly with extra feed. They also supply a superior quality of feathers in very large quantity. The female lays about the same number of eggs as the common goose, but usually commences much earlier in the spring.

The *Toulouse* constitutes the third sub-variety, and was brought to this country from the south of France, where it abounds. It is distinguished from the common gray goose by the uniformity and constancy of its color, which is alike in both sexes, and darker than in the common goose, and by its very large size being as heavy as the best bred Bremen. They are rather short-legged, have round, compact bodies, and a large development of the abdominal pouch, which, in the common goose, is a mark of considerable age, but commences its appearance in this variety when but a few months old. Like the Bremen, they lay early in the spring, are very quiet, fatten readily, and have excellent flesh.

Our common geese cross freely with the Bremen and the Toulouse, the first cross yielding birds nearly or quite as large as either parent, but the results of the cross rapidly degenerate by breeding among themselves. To keep up the size, the cross birds should be bred with one of the larger geese. The cross between the Bremen and the Toulouse is even larger than either parent, but deteriorates by breeding-in. The time of incubation of these three varieties is from twenty-eight to thirty days, according as the mother goose attends to her business for the first three or four days.

The continents of Asia and Africa have furnished us with the next family of geese, consisting of four sub-varieties, three of which are called *China geese*, while the fourth is known by the name of *African* or *Hong Kong*. These are all specifically, if not generically, distinct from those previously described. They are all distinguished by a large knob or excrescence on the top of the bill next the head, that increases with age; beak strong and high-ridged; their attitudes graceful and swan-like on the water, but stiff and usually quite erect

on land; voices harsh, loud, and frequent; while their wings and tails are short, rendering it difficult for them to fly. Time of incubation, thirty-three to thirty-five days. There is generally great dissimilarity in size, the ganders being much larger than their mates.

The three strains denominated Chinese geese are named the red-legged, the black-legged, and the white Chinese goose. The first two have dark gray or brown plumage covering the wings, back, and shoulders, the longitudinal stripe on the back of the neck almost black, while the front of the neck, breast, and flanks are fawn color, and the under and hinder parts grayish white. In the red-legged, the bill, knob, and legs are red, while these parts are black in the black-legged, and this variety has usually a narrow white stripe surrounding the feather side of the knob. These brown Chinas are both beautiful little birds, the ganders being about the size of the common kind, while the geese are smaller.

The white Chinese goose is considerably larger than the brown kinds, less erect, a long thin neck, bright orange-colored bill with large projecting knob, and legs but a little darker. It is often called the White Swan goose. All the Chinese geese are excellent layers, producing about twice as many eggs annually as common geese, commencing laying very early in the season. The fourth kind, usually called African or Hong Kong, is colored the same as the brown Chinas, with bill, knob, and legs a dull black, while in size it has no superior. It is also distinguished by a large fold of loose skin under the throat that increases with age, called the dew-lap.

The American wild goose (*Anser Canadensis*) is too well known to need a description. It is a distinct species. In a state of domestication the female does not breed until two years old. The gander will mate with a common goose, but their young are mules, and will not breed. Some flocks in the country are so thoroughly domesticated that they do not require to be pinioned, though it is generally safer to remove the first joint when young. There are several purely fancy varieties of geese that are kept to some extent, as the Barnacle goose, the White Canada or Hudson Bay goose, the Brant or Brent goose, the White-fronted or Laughing goose, the Bean goose, and the Egyptian goose.

GOOSE BREEDING.

As geese are long-lived, so are they long in reaching maturity, not becoming good for breeding purposes before they are from three to five years of age. The third or fourth year is as early as is desirable to mate geese for this purpose. Then having selected the best of their kind, one gander to no more than two geese, (and some males will only mate with one female,) and the gander not related to the geese, the breeder may consider that he is supplied with a good breeding stock for at least the next twenty years, or, as one writer says, "for life." In confirmation of this statement, Mr. S. Jaques, jr., of Boston, Massachusetts, wrote, in 1850, of a Bremen goose that his father imported in 1821: "She has never failed to lay from twelve to sixteen eggs every year for the last twenty-seven years, and has always been an excellent breeder and nurse, as has all the stock and offspring connected with her. I had the curiosity to weigh one of her brood of 1849 when nine months old exactly, and his weight, in feather, sent up twenty-two pounds in the opposite scale." The earlier the goslings are hatched in spring the better, and there is no agent so good for this purpose as the goose, though the ducks do very well. Hens appear to have too dry a heat for the purpose, and though a part of the eggs may hatch, the goslings are not as strong as those hatched by the goose or a duck. For the first twenty-four hours after hatching, like chickens, the young require no feeding. On the second day they will begin to nibble a little fine grass or young clover, from a fresh sod placed near the nest. They will also

want a little scalded corn meal or oat meal, or a few bread crumbs, and a shallow vessel of water. If the weather is fine, it will soon do to "turn them out to grass," but they should be housed every night and during stormy weather on a dry floor until several weeks old. And the better the young are fed for the rest of the season, the larger and better the fall goslings. Wheat-bran, or the best class of "shorts" mixed with boiled potatoes, makes a good feed for goslings after a few weeks old.

ENTOMOLOGY,

AND ITS RELATIONS TO THE VEGETABLE PRODUCTIONS OF THE SOIL, WITH REFERENCE TO BOTH THE DESTRUCTIVE AND BENEFICIAL INSECTS.

BY S. S. RATHVON, OF LANCASTER, PENNSYLVANIA.

In continuation of the subject commenced on page 585 of the Agricultural Department of the Patent Office Report for 1861, it seems advisable that I should, in this place, briefly notice a small *order* of small destructive insects, which are generally regarded as occupying a position in scientific arrangement intermediate between the orders Coleoptera, or "Beetles," and Orthoptera, which latter includes the insects commonly known under the names of "Soothsayers," "Spectres," "Molecrickets," "Cockroaches," "Katydids," "Grasshoppers," "Field Crickets," &c., &c.

The *intermediate* insects to which I refer have been erected into a distinct order by Mr. Westwood, which he names Euplexoptera, but which are more familiarly known by the common name of "Earwigs." Doubtless this popular appellation originates in a notion that has long prevailed in localities where these insects most extensively abound, that they are prone to enter the ears of persons who may be sleeping on the ground or in the vicinity of their nests; but as this may be altogether a misapprehension of the nature and habits of the insect, it may be of as much importance to know what it does *not* do as it is to know what it *does* do. Earwigs are nocturnal insects, and all nocturnal insects shun the light, and are very apt to creep into any dark place of concealment at the approach of light, and therefore, at the *sudden* advent of light, the earwig may have crept into the human ear; but, being exclusively *vegetable* feeders, the secretions of the ear itself would naturally expel them from it, or destroy them. That the earwig enters the human ear from choice has, I believe, not yet been satisfactorily demonstrated. Indeed, it may be worthy of inquiry whether the term is not a contraction of *Earwing*, for it will require very little assistance to the imagination to perceive a strong resemblance in form between the expanded wing of this insect and the upper portion of the human ear.

These insects were placed by Linnæus at the end of the order *Coleoptera*, immediately after his genus *Staphylinus*, because of their close alliance to that genus in their general forms.—(See figure 19, page 596, Agricultural Patent Office Report, 1861.) But Fabricius and others, perhaps more properly, referred them to the *Orthoptera*, to which they seem nearer allied in their transformations and habits. In short, they have the *form*, the transverse folding of the wings, and some of the feeding habits of the *Coleoptera*, but the masticatory organs, the active *larva*, *pupa*, and *imago*, characteristics of the *Orthoptera;*

but, differing from both of these orders, the anal segment of the body is armed with a formidable pair of forceps, which move horizontally like the *mandibles* or jaws of some species of coleoptera. This latter peculiarity of structure, or these caudal appendages, will assist the amateur in distinguishing these insects from others which they so nearly resemble in form, for these forceps are distinguishable, even in the young, which do not differ materially from the adult insect, except in the absence of wings and wing-covers, and the less developed state of the anal appendages referred to.

The *species* belonging to this order are small and few in number, but they are widely distributed throughout the world, the same species sometimes existing in countries that are widely remote from each other; but wherever they are found they are the same destructive little pests of the vegetable and flower cultivator, and will require the same means to guard against their depredations or to effect their extermination. Notorious, however, as the earwig has become in foreign countries—especially in England—it has not, thus far, been even a very common insect in the latitude of middle or southern Pennsylvania, although we frequently see or hear of damages done to flowering vegetation whilst it is in bloom that corresponds with what is recorded of these insects abroad. As they are fully as nocturnal in their habits as the *Cockroaches*, to which they are in some respects allied, and with which they are by some systematists classified, it is possible that these insects may have been the instruments of injuries sustained by vegetation which have been attributed to other causes. It is therefore of sufficient importance that a passing notice of these insects should be made here, because the fact of their existence in the United States may admonish us of the possibility of their increase to such a degree as to be capable of proving a serious injury, not only to flowers, such as pinks, carnations, dahlias, &c., but also to fruit, which they are also known toattack.

The order *Euplexoptera* consists of a single family, FORFICULIDÆ—a name derived from their anal forceps—which is mainly divisible into three genera, namely, *Labidura*, *Forficula*, and *Labia*. Most of our native species do not exceed a quarter of an inch in length, and therefore the more effectually to impress the *form* upon the mind of the reader a large foreign species is here illustrated as (Fig. 1,) namely, a male *Forficesila gigantea*. As these insects, for the most part, remain hidden during the day, in any little crevice or crack, if it is only large enough to admit the head and thorax, it has suggested the plan among gardeners of setting traps for them made out of hollow pieces of reed, ox hoofs, or anything of a similar character, containing a small quantity of hair or wool. Into these traps the insects creep at the approach of morning, after a night's prowling or marauding, and then are easily captured and destroyed. *Forficula auricularia* is the type of the family, and is about one inch long and of a dull ashen color, having a wide range of habitation, being known to exist in North and South America, Europe, and Japan. As their introduction here from foreign countries is a possible thing, and as they sometimes occur in immense profusion, destroying not only flowers and fruits but even cabbages and other vegetation, it is of some importance that something should be known of them in advance.

Earwigs deposit their eggs under stones on the ground, and the female—of some species, at least—broods over them like a hen, and after the eggs are hatched manifests her interest in the safety of the young in a remarkable manner. From the moment that the young have escaped from the eggs they have the form of the parent, all but the wings; and, without the *complete* transformation of the *Coleoptera*—which they most resemble in appearance—they undergo merely a series of moultings, continuing active feeders until they are perfectly developed. In the months of April and May they are most abundantly found under stones, outhouses, or under the loose bark of wood, concealed during the day, but, like their cousins, the cockroaches, they come abroad and maraud dur-

ing the night. Fig. 2 is *Forficula auricularia,* showing the expansion of the wings, and Fig. 3 is the young larva. A generic or specific description of these insects is not essential to the general character of these papers, and is of little importance to the practical florist or gardener.

ORTHOPTERA.

The term *Orthoptera* means "straight wings," because the insects belonging to this order have their under wings gathered up in longitudinal folds like a fan, a striking illustration of which may be found in the common "grasshopper." Almost the entire order are vegetable feeders, and are therefore in a greater or less degree destructive to the productions of the soil, although a few of them will feed, indiscriminately, upon anything that comes in their way. The ravages of some of the insects belonging to this order have been so extensive in some parts of the world, and are so well known to the masses of intelligent men, that it would seem almost unnecessary to go into any details in reference to their history and habits in this place, and yet there is so much in connexion with them that is not accessible to the general reader or the common observer that more extended remarks upon their peculiarities and their economies cannot fail to be instructive and useful to the husbandman. For the sake of facilitating their study they have been divided by systematists into at least *four* prominent sections, each of which is characterized by some peculiarity of form, structure or habit, by which they may be readily distinguished from the others. Unlike the *coleopterous* insects, they do not *visibly* emerge from the egg state in the form of a grub or worm, which is followed by a quiescent or *pupa* state, during which time there is an entire suspension of the gastronomical functions; but, on the contrary, they emerge from the egg a perfectly formed insect, lacking only the wings, wing-covers, and the more perfectly proportioned and textural development and size of the adult or parent individuals, by which we are on every hand surrounded. For the most part they feed very voraciously from the period of their expulsion from the egg all through the three stages corresponding to *larva, pupa* and *imago* in most other insects, and do not cease feeding until the end of the season, a single one of which they only usually survive. I said they do not *visibly* emerge from the egg state in the form of a "worm," and yet there is a finely spun theory, based upon very laborious and searching observations, which has demonstrated that both *orthopterous* and *hemipter us* insects *do* go through a perfect *larva* and *pupa* change, within the shell of the egg, before they are expelled from it in the form of the parent insect in which we see them, entirely overthrowing the older theory, that after the development of the *imago* state insects do not grow. Although it may have been of sufficient value to *mention* this fact in this place, yet as its practical bearings upon the subject are not of sufficient importance to make it a fundamental principle in the general plan of these papers, its further discussion will be entirely waived. The first division of the insects of this order has been classified by Mr. Westwood under the name of *orthoptera, cursoria* or RUNNERS, which includes the "cockroaches," and also formerly included the "earwigs;" but as these latter have not got the straight fan-like folding of the wings, and differ also materially in other respects, they have been separated from them, and have been erected into a new order, which has been already noticed in its place.

Of the cockroaches the most common and the most destructive species in in this country is the "Oriental cockroach," (*Blatta orientalis,*) figure 5, a female, and *B. Americana,* figure 4. Figures 6 and 7 exhibit the internal and external structure of the "egg." This insect is said to have been introduced from Asia into Europe and from Europe into America, and it is presumed that there is not now a maritime nation in the world where it does not exist. This species is

generally found about human habitations, prowling about at night in search of food, and is both destructive and offensive; but we have also a number of *native* species, found in fields and woods, under stones, timbers and bark of trees. The female cockroaches may be sometimes seen running around with a seed-like egg or capsule protruding from the caudal segment of the abdomen, nearly half its size. This is not a single egg, but, on the contrary, this capsule contains two sets of cells, arranged something like a double row of cartridges in a cartridge box, in each of which there is an egg. Along the one side of this capsule, which bears a strong resemblance in form and color to a diminutive "paw-paw" seed, there is a longitudinal vent, which is united together by a mucilage, voided with it by the female, and when the young are hatched from the eggs within the capsule they secrete a liquid which dissolves this mucilage, and thus they make their escape, leaving their infantile receptacle as entire as it was before they quitted it. After moulting or casting off their skins several times—for a few hours after which the insect is entirely white, but gradually changes to black or dark or light brown, according to the species—these insects are finally developed into the full-grown individuals we see, all the males acquiring wings capable of bearing them in flight, whilst the females are either wingless or have these appendages only short or rudimental. The *most* destructive species of these insects are too well known to need a further description of them here.

The number of species belonging to the genus *Blatta* is not great in our country, comprising six or seven, including the *orientalis*, which, as before stated, has been introduced, and from which we most suffer. If *we* suffer from this foreign importation, however, foreign countries *also* are becoming afflicted with one of our native species, which we have exported, namely, the *Blatta Americana*,* which is at least common in the maritime towns of England.

The remedies for the destruction of cockroaches are many, among which the following have been regarded as effectual. Mix a tablespoonfull of red lead and Indian meal, with as much molasses as will make a thick batter, and place the mixture in and about such places as are infested with these insects at night. Another remedy is to mix a teaspoonfull of powdered arsenic with a tablespoonfull of mashed potatos, and crumble it at night in such places as are infested with the insects, where they may discover and devour it, continuing these remedies every night successively until all are destroyed. "Costar's rat and roach remedy," kept for sale at the drug stores and elsewhere, has also been considered an effectual remedy for the destruction of these offensive insects. Great care should be taken, however, in the use of these remedies, as they are very poisonous. Various kinds of traps have been also recommended from time to time, which are nightly baited, and the contents thrown into the fire or into scalding water in the morning. As these insects love heat and are usually found in and about ovens and fireplaces, this peculiarity in their economy may suggest the most proper places where traps or poisons should be deposited, in order to secure them, or effect their destruction. A deep bowl, glazed or smooth inside, with rough and easy approaches from the outside, and baited with some substance that will attract these insects by its odor—old cheese, for instance—is considered a good form for a cockroach trap. Boxes partly filled with water, and having a nicely adjusted tilting lid, is another good form of a trap.

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* This species represented by figure 4, is more slender in form than the *orientalis:* the wings are narrower, and extend considerably beyond the body, and sometimes the wings and thorax are margined with yellowish, the color of the insect itself being a light brown. They may often be observed flying about on summer evenings, and are attracted by lights burning in chambers and elsewhere. They are very common in this locality, but not so common or destructive as the oriental.

These insects are, however, subject to the attacks of various parasites, which probably destroy more of them than ever comes to our knowledge. There are species of *Sphex*, a *hymenopterous* insect, (which will be noticed in its proper time and place,) which provision their nests with cockroaches. There are also species of *Ichneumon* (belonging to the same order) which deposit their eggs in the capsules, where they are hatched, and the young ichneumon feeds upon the egg or young cockroach. Mr. Westwood records an instance of seventy specimens of a small species of *Eulophus* (a hymenopterous insect) being taken from a single capsule of *Blatta Americana*. There are also several species of birds which devour these insects, which may account for the small number met with in woods and fields, or other exposed places, compared with those found about dwelling houses, where they are protected from these enemies. The common hedge-hog is also said to devour them. The precaution of gathering all the capsules that are found on disturbing their nests, and burning or scalding them, may also have the effect of lessening their numbers, for these capsules often contain the elements, or embryos, of from twenty to thirty cockroaches. The rapid increase of these insects, the facility with which their migration to other localities is effected, and the great injury they are capable of inflicting upon the human family, are sufficient incentives to desire their entire extermination.

The second section is called *Orthoptera raptoria*, or GRASPERS, and includes the various species of Mantes or "Soothsayers," (one of which has been figured and described in the Ag. Pat. Of. Report for 1854, under the name of "Rear-horse Mantis,") the most common and abundant species of which, in the United States, is *Mantis Carolina*—Fig. 8, adult; Fig. 9, young; Fig. 10, eggs. This raptorial section of the order *Orthoptera* constitutes the only redeeming quality that is found among them, all the others being destructive to vegetation, (and also to animal substances in some cases;) but these are *predaceous*, and feed upon other subjects of the insect kingdom, and, if straitened for the want of food, upon each other. The species is here reproduced and illustrated, in order to show their raptorial structure, in contrast with the other insects of the same natural *order*. It will be seen that their anterior pair of legs are very much developed, showing comparatively great muscular power, which enables them to seize and hold other insects whilst they are devouring them at their leisure. In the first section it was seen that all the legs of the insects belonging to it were of equal symmetrical development and power, because they were formed for *running;* but in this section a great inequality exists, the insects belonging to it being formed for *grasping* their prey; and, therefore, the posterior and intermediate legs are formed for a slow, stealthy movement, the insects lying in wait for, and pouncing upon, any luckless denizen of the insect world that may come within reach of their rapacious grasp. When the husbandman observes an insect with this peculiarity of structure he may feel assured that it is permitted for a specific purpose, and that that purpose is the seizing and retaining of some object that would otherwise be likely to make its escape. The Mantis or Soothsayer is also common on the continents of Europe and Asia, where the singularity of its posture, whilst watching for its prey, has given rise to many superstitions, tales, and beliefs, which are retained, in many instances, in its nomenclature. The country people of France, therefore, assuming that it is engaged in prayer, have named it "*Prie Dieu,*" and the Germans call it "*Gottes Anbeter;*" hence, also, have been derived the Latin specific names, "*religiosa, precaria, oratoria, mendica, superstitiosa,*" and others. Saint Francis Xavier seems to have almost deified it among the common people by endowing it with extraordinary understanding and vocal powers. It *is*, however, a "*preying* Mantis;" but in the word *pray* the letter "*a*" must give place to the "*e*," which will leave the name in true conformity with its real character.

Fig. 1.

Fig. 1 *a.*

Fig. 2.

Fig. 3.

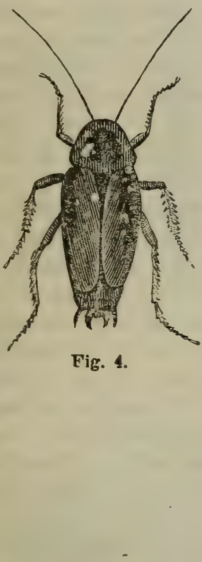


Fig. 4.

Fig. 5.

Fig. 5 *a.*

Fig. 10.

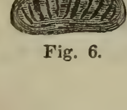


Fig. 6.

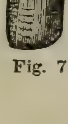


Fig. 7.

Fig. 8.

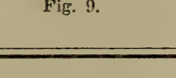


Fig. 9.

Fig. 11.

Fig. 12.

Fig. 14.

Fig. 15.

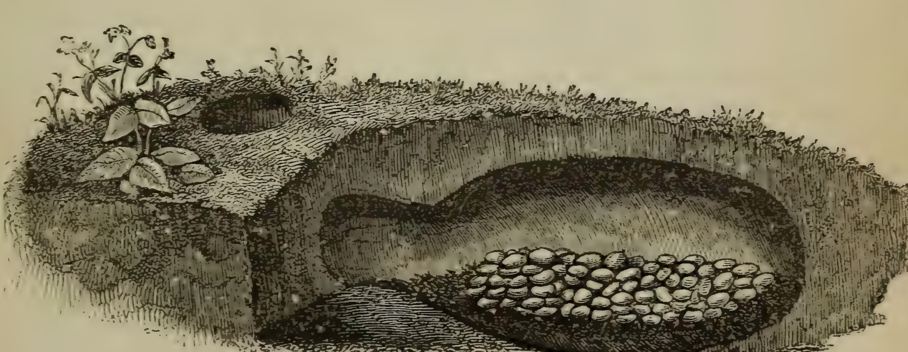


Fig. 13.

Fig. 16.

Fig. 17.

Fig. 18.

The *Mantis Carolina*, Linn., when full grown, is about two inches in length; some specimens exceed that length, and others do not attain it. The color varies from a greenish to a mottled brown, according to sex and age; the thorax is nearly half the length of the body; the eyes are prominent, and the antennæ filliform, or slender and hair-like. As before remarked, all the legs are slender except the anterior pair, which are very much "produced," and are spiney or toothed along the lower margin of the tibia. These insects are principally confined to the middle and southern States, where they perform a most important use as scavengers of some of the noxious tribes, being known as most voracious feeders, daily destroying a large number of caterpillars, aphids, moths, flies, or any other insect that may happen to fall in their way when hungry. In autumn the females lay from fifty to a hundred oblong eggs, that are longitudinally cemented together and fastened to a branch, having something the appearance of a miniature honeycomb, where they remain exposed to the weather all winter, and are hatched in the spring. The amount of cold these eggs are capable of bearing may be inferred from the fact that the Mantis has been successfully raised for two or three consecutive seasons within the limits of Lancaster city, Pa., from eggs brought here from Maryland, during which time, on several occasions, the cold had been from four to ten degrees below zero.

I feel justified in this extended notice of this insect in this place because of its great usefulness, and because I believe it capable of being colonized in favorable localities considerably north of its usual range. For instance, in gardens exposed to a southern sun, and protected against the cold northern blasts, it would be an invaluable and constant assistant in protecting vegetation from the incursions of *aphids* or other noxious insects. In hot or cold "green-houses" they could be unquestionably reared with entire success. In the Royal Botanic Garden of Edinburg, some years ago, the "Leaf Insect" (*Phyllium scythe*) was for several years successfully raised from eggs originally brought from the East Indies. This insect belongs to the same natural order that the Mantis does, and is nearly allied to it in its development, although, being a vegetable feeder, differing from it very materially in its habits. The Mantis are even, in some degree, capable of domestication; for it is not an uncommon thing in their native localities to find them so familiarized with certain individuals as to receive food from their hands. The young of these insects differ very little from the adults except in size and the absence of wings. It is recorded that in the absence of other prey these young sometimes fall victims to the rapacity of their parents; and that if pressed for food even the adults will attack each other, the weaker subjects in these contests being seized and devoured without ceremony by the stronger.

The third section is called *Orthoptera ambulatoria*, or WALKERS, and includes a weak and slender-legged family of insects called "Spectres," or "Walking-twigs," "Leaf Insects," &c. Many of these insects exhibit very extraordinary forms, resembling animated leaves or small twigs; hence their common names; but most of them belong to warm or tropical climates. In the United States but two species have been discovered, which have been described by Say under the names of *Spectrum femoratum* and *S. bivittatum*, the former of which is illustrated by Fig. 11, a male specimen. The body of some of these insects, when full grown, attains to fully three inches in length; the color, various shades of green; and the limbs are long and slender, the intermediate and posterior pair of legs being armed with a short spine, near the end, on the lower margin of the femur, and the antennæ being long and thread-like. The bodies of the females are more robust than those of the males, and the legs and antennæ are shorter, and they are destitute of spines. These insects move slow and sluggishly over the foliage of plants and shrubs on which they feed, having a partiality for the young leaves and buds of the

sassafras, (*Saxifraga;*) but they are not yet sufficiently numerous in this country to cause any serious alarm, although in foreign countries allied species have been destructive to vegetation. It is well, however, to make a record of them in their proper place, and to admonish the cultivator of the soil, and especially the nurserymen of our country, that as these insects can be of no possible *benefit* to vegetation, but may be *ultimately* an *injury* to it, therefore when they meet them they may know precisely what disposition to make of them. Under any circumstances it would neither be wisdom nor good husbandry to allow them to increase; for attaining such formidable proportions, and being so closely related to the greatest cormorants of the insect race, if they should haplessly occur in great numbers, they would not be long occupied in defoliating trees and shrubbery to an immense extent.

The fourth section is called *Orthoptera saltatoria,* or JUMPERS or LEAPERS, and includes the various species of grasshoppers, crickets, locusts, &c., &c. The *crickets,* which are usually considered first in scientific arrangement, may, for the sake of convenience, be divided into three kinds, namely, *burrowing* crickets, *field* crickets, and *climbing* crickets. Perhaps the most singular in their structure, and the most injurious in their habits, are the "burrowing crickets," or perhaps more properly called *mole crickets,* from their resemblance to a ground mole in the form of the anterior legs and the front of the body. These insects are known to scientific men under the generic term of *Gryllotalpa,* which is a combination of the Latin names for a *mole* and a *cricket.* The most common species belonging to this *genus* in this country is the *Gryllotalpa brevipennis* of Harris—*G. borealis* of Brown. This insect is found in low and moist gardens and meadow lands* burrowing in the earth similar to a "ground mole," doing considerable damage to vegetation by destroying the roots. Fig. 12 is an illustration of this species, and Fig. 13 is the nest and eggs. When full grown this insect attains from one inch and a quarter to one inch and a half in length; the color is a light bay brown or fawn color; and it is covered with very short hairs, giving it a soft velvety appearance. It will be observed that the anterior pair of legs is very much developed, giving them in some measure the appearance of the *hands* of the *mole.* With these digging facilities the insect is capable of burying itself in the earth in an incredibly short space of time. The posterior pair of legs is also proportionately large, giving the insect the power also of leaping; but it cannot leap far, and depends more upon its digging powers than upon any other in obtaining its food, living, as it does, upon the roots of vegetation. In foreign countries the mole cricket has been known to be exceedingly injurious, and possibly vegetation may have sustained injuries by them in this country without persons having known what has been the cause of such injuries.

In the West Indies this insect, or rather a species called *Gryllotalpa didactyla,* has been charged with the destruction of the sugar cane, and it is not impossible that in the United States our insect may become equally injurious, when its number increases as it has in other countries. The European species is said to lay from two to three hundred eggs, of a brownish color, and the inference is that our native species are equally prolific. Some years ago I discovered a nest containing a large number of eggs, perhaps two hundred or more, without knowing to what insect they may have belonged; but I have since been satisfied that it was the nest and eggs of a mole cricket, for the insect was also found in the same locality, and the former corresponded, so

* In a meadow near the Conestoga river, about one mile from the city of Lancaster, last year, Mr. George Hensel, of this city, captured over one hundred specimens of *Gryllotalpa brevipennis* in a piece of ground about six feet square. The vegetation upon it was entirely destroyed, and it looked as if it had been scorched with the rays of a burning sun, so completely was everything dried and shrivelled up upon it. The owner of the property had no idea that the damage had been caused by these insects, nor had he ever seen one before.

far as I can recollect, with descriptions which I have since read of the nests and eggs of these insects. As it takes the mole cricket three years to mature its state, it will be seen that during that time it will require a considerable quantity of food, and that therefore it may become proportionably destructive. The nests are hollow cavities in the earth, made smooth inside, having a single passage leading into them, but around them there are usually a number of diverging passages or chambers, and the earth immediately surrounding the eggs is packed so tight, or is so permeated with an adhesive fluid as to render it capable of being lifted out entire, if care is observed. The insect is said to raise and lower these nests according to the variation of the temperature of the weather of the summer or winter season. These insects are nocturnal in their habits, and only issue from their burrows at night, when they also sometimes take the wing, and, like other nocturnal insects, are attracted by the light of a fire, a lamp, or a candle. Grated carrots, mixed with arsenic, and strewed in localities where they abound, is said to be a good remedy for their destruction, for they eat immoderately of this root.

Figure 14 is a singular insect, of the same natural *order*, and nearly allied to the mole cricket, from California, where they are found in great abundance. I know nothing *positively* about its habits, it having been sent to me by a friend from the valley of the Sacramento, without note or comment, but it may be inferred from the large *pro thorax*, and the large anterior legs, terminated by a hand, similar to that of the mole cricket, that this insect is also a burrower in its habits. The insect alluded to is full two inches in length, of a light brown color, entirely without wings, smooth all over, and with long filliform antennæ. The head is very large, the eyes projecting, near, and immediately behind the base of the antennæ; the jaws or mandibles are dark brown, short and stout, and the palpi are long and four-jointed, including a very short terminal joint. The posterior and intermediate legs are proportioned very much also like those of the mole cricket, except that the spines along the posterior margin and the terminus of the tibia are more numerous and larger than those of the insect just named. The abdomen is large and composed of eleven segments, including the caudal one, which is terminated, like in most crickets, with a pair of hairy spines or *setæ*, except that they are shorter and more robust.

These insects present *forms* for the ready recognition of the husbandman, that are as essential to him, in a practical sense, as the fullest knowledge of their history and habits can possibly be; for of what avail is it to know that an insect does certain damages, if he is unable to recognize the perpetrator of those damages when he discovers it under other circumstances? Moreover, the external anatomical structure of an insect is often fearfully indicative of its specific character; for if the large *posterior* legs of an insect teach us that they are necessary to contain the muscular power required for leaping, so, also, the large *anterior* legs must speak a corresponding language, and inform us that they are required in one modification of form to dig and destroy, and in another to seize, to hold, and to devour.

The *second* kind of crickets to be considered are the field and house crickets, of which there are a number of species. Of the house crickets Dr. Harris has said that we have none in this country, which Mr. Uhler, in an editorial note to the Doctor's work on insects, says is a mistake, so far as other localities than Massachusetts are concerned. For myself, I have often seen and heard the "cricket of the hearth" in middle and southern Pennsylvania, from my boyhood up to the present, or at least until a not very remote time, in houses that were favorable for their local habitation. These may have been field crickets, drawn thither by the approach of autumn and winter; but I recollect distinctly of having heard them as late as the end of December, in the State of Kentucky. These insects do not confine themselves entirely to vegetable food, and accordingly, it is recorded of the house cricket that it destroys any

cockroaches or other insects that may trespass upon the premises which it occupies. During the present season I have on various occasions observed two or three species of field crickets preying upon the dead carcases of field mice, and other recently slain animal matter, in company with several species of "burying-beetles," (*Necrophorus*.) They seemed to be perfectly intoxicated with their repast, and were altogether regardless of my approaches, and thus entirely different from what they usually are when found upon vegetation in the open fields. Crickets also attack other insects sometimes, and occupy cavities in the earth, under stones, from whence they pounce upon any luckless intruder that may come in their way; but for the most part they live upon vegetation, and sometimes are very destructive. Crickets deposit their eggs in holes in the earth, where they remain all winter, and are hatched out by the warm sun of the following spring and summer, after which the larger number of the adult insects die; but, as some of them do survive the winter, hiding themselves under timbers and stones, in nicely formed burrows, secure and dry, the inference is, that these, at least, deposit their eggs in the spring, as soon as vegetation is sufficiently advanced to sustain their young, when they are hatched. In localities where crickets may have been injurious to vegetation, it would be well to destroy all of those that are found in the winter season, as the probable progenitors of the vast multitudes which are met with on every hand during the summer. These insects may be poisoned in the same manner as mole crickets are, for they seem also to be fond of carrots and other roots of a similar nature. It may be of some importance to the farmer and gardener to know that the creaking chirp of the cricket is not a vocal sound, but that it belongs exclusively to the male insect, and is produced by the grating together of the wing-covers of that sex. Figure 15 represents our common black field cricket, (*Acheta abbreviata*,) so called from the abbreviation or shortness of its wings, which do not cover the abdomen. This insect is about three-quarters of an inch in length, and is entirely black, except the base of the wing-covers, and a line on each side above the deflexion of the border, in the females, which is a pale brown. The females are provided with a long ovipositor, with which they deposit their eggs in the ground. This insect hides itself under stones and timbers, and when they are overturned the insects scamper off in various directions in a great hurry and in seeming distress, sometimes satisfied if they can only hide their heads under any small object, whilst the other portion of the body may be exposed to view; in this respect bearing some resemblance to the habits of the earwigs and other nocturnal or darkling insects. Figure 16, (*Acheta vittata*,) or the striped cricket, is by far the most numerous and most social insect we have belonging to this order. They do not avoid the daylight, as other species do, but seem rather to court it, and may be seen at any time in countless numbers, in fields and along paths or roadsides. On a recent visit to the country, on a warm day in November, I found thousands of these insects feasting upon the dead carcase of a calf that had not yet become putrid, and from which they could not be driven without repeated efforts. This insect is much smaller than the black cricket described, being only about three-tenths of an inch long, and being without the under wings which are present in other species. There is considerable variation in the color of these insects, from a dusky brown to a rusty black. There is a black line on each side of the thorax longitudinally, and also three lines on the head; in the darker varieties these lines are not so conspicuous as in the lighter ones. From the immense numbers of them which are met with in seasons favorable to their increase, and from the fact that they are constant, greedy feeders from the time they are excluded from the egg in the spring until they are overtaken by the cold of the late autumn and early winter, it must needs be that they can become very destructive to vegetation, and therefore ought to be destroyed. As

they are voracious, indiscriminate feeders, they could easily be destroyed by placing poisoned meat or vegetables in the places which we desire to be protected against their ravages.

A *third* kind of crickets, which are pretty generally diffused throughout our whole country, are the *climbing crickets,* although they do not occur so abundantly as the kinds just noticed. Of these there are also several species, but the most common in the latitude of southern Pennsylvania is the *Œcanthus niveus;* figures 17, the male, and figure 18, the female. The sexes differ so widely from each other in form that they might very readily be taken for two distinct species. From midsummer until autumn these insects may be found on shrubbery and other vegetation, into the tender stems of which the females make perforations and deposit their eggs, which are hatched about the middle of July, and the young then feed upon the tender leaves. The male insect of this species is of a uniform white color, slightly tinged with green, except an ochery-yellowness of the front of the head, between the eyes, and the first joint of the antennæ. The legs and antennæ are long and delicately formed. From the head to the end of the wing-covers, which lie flat upon the back, the insect is about three-quarters of an inch in length, but the body is scarcely half an inch long. The female is larger than the male, but the wing-covers are much narrower, and in many cases the color is much darker, varying from a pale or greenish white to a yellowish or dusky brown. On the head and thorax are three dusky stripes. These insects have been charged with piercing and depositing their eggs in the peach tree, and with eating holes in the tobacco plant. I have frequently found them on grape vines, the leaves of which were perforated with holes, and although there are a number of other insects that are known to be destructive to the foliage and fruit of the grape vine, yet there is strong circumstantial evidence, if not positive proof, against this insect, as being *also* a depredator upon the vine.

The "climbing crickets" keep themselves hid during the day among the foliage and flowers of plants and shrubbery, and are then perfectly noiseless; but as night approaches they come forth, when the male commences his incessant shrill chirping notes, which are produced by the rubbing together of the upper wings, as in other crickets, which he continues until the approach of morning warns him to desist, to the great annoyance of any luckless sleeper into whose chamber he may happen to introduce himself. This insect is capable of both flying and leaping, but its power to leap is very limited, as the slender structure of its limbs will show, and therefore it is usually found sitting crouched down to a leaf or a stem, or walking slowly over their surface, and accordingly it may be easily captured by the hand and destroyed. The foregoing illustrations and the accompanying descriptions may serve to impress upon the mind of the reader the *forms* of the insects alluded to.

The second division of the section *Saltatoria* or leaping insects, includes the *Grasshoppers,* of which there are various kinds, most of which are distinguished by their vegetable-green color, their slender limbs, and their long thread-like *antennæ* or horns. This division includes the "Katydids" and their immediate relatives, many of which bear more or less of a resemblance to that type. They do not leap much, but walk slowly over the surface of vegetation, and only take a short leap when disturbed; at least this is the case with the young before the wings are fully developed; but some of the adult individuals are capable of a long and rapid flight, of which they frequently avail themselves when they are disturbed in warm weather; but they are easily rendered inactive by cold, and consequently the first cool evenings at the end of summer or the approach of autumn renders the Katydid and its congeners almost entirely helpless and very easy to capture. Fig. 19 represents a female Katydid of Pennsylvania, (*Platyphyllum perspicillatum,* Fab.,) and Fig. 20, exhibits the eggs. This insect is about two inches in length, of a bright green color, and

the ovipositor of the female, which is sword-shaped, extends about the eighth of an inch beyond the wing-covers. Although its song is well known throughout the States, yet many who have heard it are altogether unable to recognize the insect when they see it, as there are one or two other insects of this family which nearly resemble it in size, color, and form. In the true Katydid the wing-covers are broader and shorter, and also more convexed, than in any other species allied to it, and the head and thorax are also proportionately larger. These insects reach their mature state by the end of August or the first of September, when the female lays her eggs in two rows, overlapping each other, on the twigs or small branches of shrubbery and of trees.

There is another grasshopper of about the same size and the same color, and also of habits similar to the Katydid, which is yet quite different in its structure and the proportions of its parts, and does not make the same distinct "Katydid" pronunciation in its song. This insect is the *Phylloptera oblongifolia*, in which the wing-covers are narrower than in the former species, and are about a quarter of an inch shorter than the wings, which extend beyond the ovipositor of the female. The posterior legs are also longer, and the anterior and intermediate legs are shorter and more delicately formed than those of the true Katydid. This insect lays its eggs also on small branches in double rows of eight or nine each, like the former, to which they bear a very close resemblance. Another species of the same green color, but of much longer and narrower wings and wing-covers, and shorter body, is the *Phaneroptera curvicauda*, illustrated by Fig. 21. But by far the most numerous species—and which is sometimes very abundantly found in meadow-lands upon the grass—is a small light green grasshopper, with a brown stripe on the top of the head, and the wing-covers tapering to the end, of a green color faintly tinged with brown along that portion which overlaps each other. The ovipositor is cimeter-shaped, and the antennæ are long and thread-like, as in the other grasshoppers named. This is the *Orchelimum vulgare* of Dr. Harris. A commoner species in this locality is the *Orchelimum gracile*, illustrated by Fig. 22, and measuring about three quarters of an inch in length. A distinguishing characteristic of the true "Grasshoppers" is, that they have very long and filliform antennæ, differing from the crickets—which have also long and thin antennæ—in the deflexion of the wing-covers, in their color, in the absence of the two caudal filaments, in the sword-shaped ovipositor, and in the length and slenderness of their limbs. Some of these latter species named are very active "leapers," and in warm days are exceedingly hard to capture.

There are numbers of other species that cannot be noticed in a limited paper upon this subject, but which all bear a general resemblance to those named and figured, and also approach them in their economics, their habits, and their modes of propagation. It may be of some importance to mention here that the "Katydid" and its immediate relatives do not deposit their eggs in the ground, as has been asserted, but on small twigs and branches, as before stated. Indeed, the habits and economy of the insect seem to contradict such a theory altogether, for it is nearly always found feeding and climbing aloft on shrubbery and trees, and very rarely upon succulent vegetation. Fortunately for us in the States, these insects are usually the most numerous and voracious about midsummer or after that period, when vegetation has gotten too much of a start to be much injured by them, unless they appear in greater numbers than they ever have appeared heretofore. Their numbers might be greatly diminished if trees and shrubs were examined during the fall, winter, or spring, while they are destitute of foliage, for then the eggs can be readily seen, gathered, and destroyed. The difficulty of poisoning these insects would naturally be much greater than that of crickets, for the reason that their whereabouts is not so accessible. Sweeping over the foliage and grass with a sort of bag-net, in the morning early, when these insects are not as active as they are at midday

would capture a great many of them, which might be scalded and then fed to pigs and poultry, as they are very fond of them. The injuries done to vegetation are so great, and the injurious species so numerous, that the horticulturist and farmer cannot learn too soon to recognize noxious insects and distinguish between them and innoxious species, because those that are comparatively harmless *now*, may, in a few years, by their increased numbers, become *very destructive.*

Another division or family of the *Saltatorial orthoptera* is that which includes the *Locusts*, the most voracious and destructive insects belonging to this or any other order; but more destructive in foreign countries than they have been, thus far, in the United States. In speaking of these orthopterous insects by that name it is hardly necessary to admonish the reader that I do not, even the most remotely, allude to those insects which have incorrectly received the name of *locusts* in the United States—but which belong to an entirely distinct order of insects—such, for instance, as the "Summer locust," the "Seventeen-year locust," &c. In no other country has a similar blunder been made in the vulgar nomenclature of this insect, and the correction may as well be made first as last. It will be seen in the course of these papers how far these names may be properly applied to these insects, and the benefits resulting from a proper application of names. Our *locusts* agree in their forms, their habits, their economies, and their modes of propagation, with the locusts of Africa, Asia, Europe, and especially with the Egyptian locust, of whose destructive qualities we read in Holy Writ and elsewhere. If priority of nomenclature is entitled to precedence in speaking and writing of any object of natural history, it is the same whether the name is a common or a technical one; and when we know that an insect indigenous to our own country has the form of one belonging to a foreign country, and also agrees with it in all other respects, then, in common language at least, it ought to be called by the same name, where a name has been previously given. This is precisely the case with a family of our "Grasshoppers"—so called without distinguishing between them and the *true* Grasshoppers—but which are *locusts* in all the essentials which constitute that family of destructive insects. This also clearly illustrates the necessity of the scientific names of animals, else we could not be generally understood when speaking or writing of any animal by the common names which it may have received in the various localities where it exists.

These insects differ from the crickets and the grasshoppers by having the antennæ short and of equal thickness; by the abrupt deflexion or roof-shape of their wing-covers, which entirely cover the lower wings; by the females not having the sword-shaped ovipositor protruding from the end of the abdomen; and by having the legs shorter and more robust, and therefore better adapted to leaping than the true grasshoppers; and by having the power of flight also much greater than the last-named insect, the wings being in most cases very large, the wing-covers narrow, and the muscular power of the thorax much developed. These insects, when occurring in large numbers, make a great noise in their flight, the cause of which is not easily explained. Some species, when fully developed, which is usually about the end of August, are in the habit of poising themselves in the air, making a curious rickety noise, seeming to be trying their powers of flight, and perfectly intoxicated with delight at its efficiency. Asia and Africa, particularly, have suffered greatly at different times from the ravages of locusts, and the ground over which they have passed has presented the appearance of having been scorched by fire, so completely has the vegetation thereon been removed, and hence we have the name *locust*, which is derived from the Latin *locus* and *ustus*, which means "a burnt place." Famine and great distress, as well as pestilent diseases, have followed the appearance of the locusts in those countries, and consequently all that has been written in the Scriptures concerning these insects has been fully confirmed by the obser-

vations and experiences of travellers and others in those countries where they abound. In Central and South America, in Mexico, as well as in some of our Pacific States, allied species of these insects have often occurred in vast numbers, and not much less destructive than those of Asia and Africa—and especially has this been the case in New Mexico, Arizona, and Utah. Smaller species have at various times abounded in the eastern, the western, the middle, and the southern States, which have been more or less destructive to the blades of young corn, to meadow grasses, and, in short, to almost every vegetable of an edible character where they existed.

Locusts are usually comprised under three generic divisions, all of which are in a greater or less degree destructive, but still sufficiently unlike to warrant such a separation of species, when arranging them systematically. They are so well known under the common but miscalled name of grasshoppers, that it is perhaps necessary in this place to do little else than just to give a few illustrations and a passing notice of some of them. The family is so large, when we take all the species together that inhabit the different parts of the world, that it has been necessary to divide them into a larger number of genera, but *three* may comprise those that are usually found in the old States.

The first of these is the genus *Acrydium*, in which the wing-covers are of only ordinary dimensions; and they have a spine projecting from the middle of the breast below; they have also small projecting cushions between the claws of the feet. The second genus is *Locusta*, the type of the family; without the spine in the middle of the breast; with the wings and wing-covers of ordinary size, but still, as a general thing, more ample than in the former genus, and also with the foot-cushions between the claws or nails.

The third genus is that of *Tetrix*, with the thorax much prolonged, covering the whole of the abdomen, and tapering to a point; the wing-covers are very small, and the insects are without the spine in the breast also; the forepart of the thorax forms a sort of projection, in the form of a stock, to receive the head; no cushions on the feet. Of the spine-breasted locusts (*Acrydia*) there are a number of species that are properly referred to other genera, as, for instance, *Opsomala*, *Xiphicera*, and *Romalea;* but it will only be necessary in this place to illustrate one or two of those before named. Fig. 23 represents the most common and most numerous, and therefore, perhaps, also the most destructive species that we have in this locality; it is the *Acrydium* (*Caloptenus*) *femur-rubrum*, and on several occasions has been a perfect scourge in various parts of our country, especially in the State of Maryland, and, according to Dr. Harris, on the salt marshes of Massachusetts. In the months of August and September, 1839, they were exceedingly numerous and destructive in Lancaster county and other parts of Pennsylvania, eating up all kinds of vegetation, even to the loose particles upon the surface of old rails and boards, and rising in clouds high up in the air, filling it as far as the eye could reach, to the partial obstruction of the rays of the sun. There were also other species, especially the *A. flavo-vittatum*, a greenish or olive-colored kind, of about an inch and a half in length; but the red-legged locust predominates in numbers and destructiveness by great odds. This insect is from three-quarters to one and a quarter inch in length, and the wings expand about the same. The color is a dirty olive of lighter and darker shades, and there are two long black spots extending from the eyes along the sides of the thorax; the hindmost thighs have two large spots on the upper side, and the extremity is black, but they are red below and yellow on the inside. The hindmost shanks and the feet are blood red, from whence the insect derives its name, including the red upon its thighs.

Fig. 24 is *Acrydium alutaceum*, a large, leather-colored locust, very extensively abounding in the locality of southern Pennsylvania for the past five years, and seemingly on the increase. Some specimens of this insect are fully

Fig. 19.

Fig. 20.

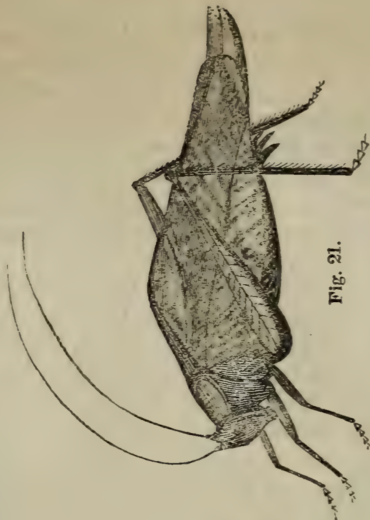


Fig. 21.

Fig. 22.

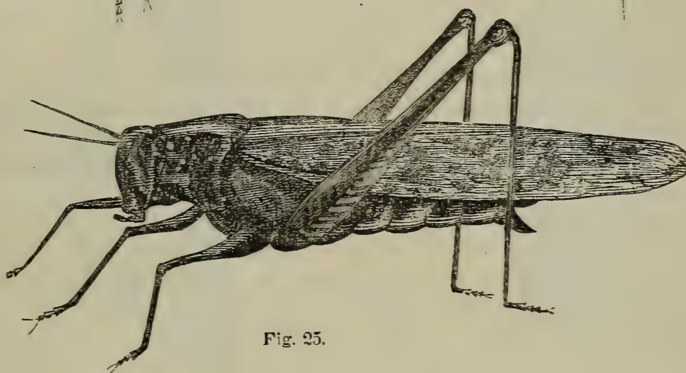


Fig. 25.

Fig. 25 *a*.

two inches in length from the head to the end of the wing-covers and abdomen, and expand about three and a quarter inches across the wings; the color is a dirty brownish yellow, or like uncolored leather; the antennæ are short in proportion to the size of the insect, and the abdomen has transversed rows of black dots upon it; the shanks or tibia are armed with numerous yellowish spines tipped with black. It has not usually occurred in such vast numbers as the "red-legged locust" first described, but, being much larger, should it become as numerous as the other, it certainly would be capable of doing more injury. By far the largest species, however, known to me as inhabiting the latitudes of Pennsylvania is the insect represented by Figs. 25 and 25*a*, (*Acrydium Americanum?*) which measures, from the front of the head to the end of the wing-covers, nearly two inches and three-quarters, and to the end of the abdomen nearly two inches and a half, and it expands across the wings about five inches, the species varying more or less from these measures according to local circumstances; the wings are transparent, colorless, and large, forming fully a quarter of a circle, and the wing-covers are narrow, and ornamented with roundish and oblong brownish spots on a yellowish ground, with narrow stripe along the posterior margin without spots, which, when closed over the back of the insect, leaves a distinct yellowish line, which unites with one that runs longitudinally from the front of the head to the hind margin of the thorax, and terminates in a point near the end of the wing-covers. The thighs have a very distinct fern-leaf ornamentation on the outside, with two black blotches on the top, and a black spot inside and outside near the end, with a whitish pearly spot immediately below them; the shanks or tibia are reddish, and armed with numerous spines tipped with black. I have never seen a description of this insect, nor yet a minute description of the *Americanum*, and therefore it has occurred to me that it may be a different species from the insect of that name found in the south; on this account I have marked it with a doubt. In its general form and proportions it nearly resembles the *A. alutaceum*, but it is much larger, differently colored, and the longitudinal dorsal ridge of the thorax is not so prominent as in this last-named insect. Seven years ago it was not common in Lancaster county, and during a long residence in the western part of the county, where I devoted more time to the exploration of its woods, hills, and fields, in one month, than I have since been able to devote in a whole year, I had never observed a single specimen of this insect; but now it is becoming every year more abundant and consequently more common. A great and unexpected increase of its numbers would, no doubt, prove it to be as much of a destroyer as those Central American species are, or even the famous migrating species of eastern countries. This insect, having very large wings, is capable of a very rapid and continued flight, and is therefore capable, also, of vastly extending the area of its habitation. The question of its destructiveness is simply one of time and of numbers, and a favorable opportunity for its rapid multiplication may occur at any season, when all the circumstances calculated to produce such an effect shall have combined together.

With this insect I will proceed to notice two or three of the genus *Locusta*, or locusts proper, which are none the less destructive, although they may not attain the sizes of some of those which have been already named.

In speaking of the locusts *proper*, it may be well to remark that we have probably not a single species, in the old States, at least, that may properly belong to the restricted genus *Locusta*, for all, or nearly all, of them seem to have been referred to different genera. It would be fortunate if the insects themselves could be so easily shifted, for then we would only need to transfer them to the bottom of the ocean to put an end to them. The name *Locusta* has been applied to that genus of orthopterous insects which includes the celebrated migrating locust of the east, the *Gryllus Locusta migratoria* of Linnæus, to which it is not necessary to make any more than this slight

allusion in this place, and that only for the purpose of exhibiting how nearly allied, in their characters and forms, some of our own insects are to those destructive hordes which have been, from very ancient times, considered one of the great plagues of mankind. It *does* seem of sufficient importance, for the farmers and fruit-growers of our country, to impress upon their minds the *forms* and *characters* of these insects as those of the true locust—an insect which is capable of a fearfully rapid increase, and where so increased possessing a voraciousness which continues from the time it is expelled from the egg, in the spring or early summer, until it is overtaken by the frosts of autumn, and under favorable circumstances one generation succeeding another in the same season. That they possess, also, ample powers of flight, enabling them to migrate from one district which they may have devastated to another that may promise a fresh and more abundant repast, and that their masticatory organs, for insects of their size, are as formidable as the most ravenous that belongs to the domain of nature. This is not the case with an insect of a different *order*, and of a different organization and form, which has incorrectly received the name of "locust" in this country. *This* insect only appears at long intervals, only remains for a limited period, and is entirely without masticatory organs, and is not absolutely known to take any food at all while it remains with us. Whether the husbandmen of our country can ever accustom themselves to think of and regard the insects commonly called by them "grasshoppers" as possessing all the possibilities to become as destructive as the *real* African or Asiatic locust, and whether they can accustom themselves to regard the advent of the seventeen-year *Cicada* with indifference, or with that absence of superstitious dread which, in some localities, attaches to it, remains to be seen; but in any event, whether the proper names are applied to one or to both of these insects or not, it cannot affect their general *characters*, and an acquaintance with their characters is the great *desideratum* of the day.

The genus *Locusta* differs from that of *Acrydium*, mainly in being destitute of the little projecting spine upon the breast, immediately between the anterior pair of legs. The largest and most numerous species by far that is known to this locality is the very familiar *Locusta Carolina* of our roadsides and fields, from the middle of July to the end of the season. This insect is represented by Figs. 26 and 26*a*, and is about an inch and a half in length, of a pale yellowish-brown color, with small dusky spots. The under wings are a bluish black, with a broad yellow posterior margin, with dusky spots near the outer ends. The males and females pair in the months of September and October, according to the favorable or unfavorable state of the season, after which the female immediately proceeds to deposit her eggs in the ground, which she accomplishes by inserting the end of her abdomen and distending the four little ovipositor-like instruments with which it is provided, making a smooth cylindrical hole, where the eggs remain all winter, and are hatched out in the spring. These locusts are found in association with various other *genera* and *species*, the most numerous of which is the "red-legged" locust before mentioned. When their wings are fully developed, they make ample use of them in their flight, only using their hind legs as propellers in rising from the ground.

The next species, in point of numbers, is the yellow-winged locust—*Locusta sulphurea*—represented by Fig. 27. This insect is about one inch and a quarter in length, and expands about two inches; the color is a dusky brown, and the thorax is raised slightly into a keel into the middle; the under wings are a deep yellow; with a broad dusky posterior margin, very much widened at the ends. This insect, some years ago, was not so common in this latitude as it is now, nor is it uniformly as common *every* season as the *Carolina* is.

There is also a number of smaller species of locusts, with the wings much shorter than those species already named, one of which is the *Locusta* (*Chloëaltis*) *curtipennis*, Fig. 28, which is from a half to three-quarters of an inch in length,

of a grayish color above, variegated with black, and the legs and the under side of the body yellowish; a broad black line extends from behind the eyes on each side along the thorax; the wing-covers of the male are nearly as long as the abdomen, in some specimens quite as long, but in the females they are short, not covering more than two-thirds of it. If I had not often taken these insects paired, I should have supposed the females were only immature specimens. Besides these there is a number of other species, all bearing a general resemblance to the foregoing in their forms and habits; but as these insects are so very common in all localities, it is not the design of this paper to give a detailed description of them, the object being merely to direct the attention of those interested to the *forms* and *economies* of a class of insects, which it must be to their advantage to have diminished in numbers, if they desire to enjoy an immunity from their rapacity. It is to the indifference to the increase of the denizens of the insect world, and the ignorance of the mode and manner of their reproduction, and the times and seasons in which they are most destructive, that many of the evils which we suffer from them may be attributed.

Before concluding the descriptive part of this paper I must avail myself of the opportunity of noticing one more species of locust belonging to a group called, in common language, the "Grouse Locusts," on account of their generic name *Tetrix* having been applied by the Greeks to a species of *Grouse*. These insects in this locality are more frequently found along the borders of woodland among the grass—but basking themselves in the sun in some proportionately elevated position—than elsewhere. They possess extraordinary leaping powers, in which they are also assisted by an ample pair of wings. The most striking distinguishing characteristic of these insects is the peculiar formation of the thorax, which is prolonged behind to a point, and is extended beyond the abdomen, and in some instances beyond the wings. The heads, also, of the insects belonging to this genus are much smaller than those that belong to the genera *Acrydium* and *Locusta*. The most common species in Pennsylvania is *Tetrix lateralis*, or black-sided Grouse Locust, (Fig. 29,) which is about half an inch in length from the front of head to the end of the wings. The sides of the body are blackish, and the top of the thorax is sometimes an ashen, and sometimes a yellowish clay color. A slightly elevated ridge runs longitudinally through the centre of the thorax from the head to the hinder extremity. Although a quarter of an inch is the maximum length of these insects, yet from the close resemblance of their habits to those of the other members of the locust family, the inference is that they may become quite as destructive where their numbers are equal. The young, before they have acquired their wings, bear a strong resemblance to the young of the genus *Membracis*, which belongs to the order *Homoptera*, and in this respect may be regarded as the connecting link between the *Orthoptera* and *Hemiptera*. In both of these genera—that is, in *Tetrix* and *Membracis*—the thorax extends in a wedge-shaped or tapering point beyond the abdomen, and in both the leaping powers are extraordinarily developed, the advantages of which the young, in the absence of wings, can only avail themselves in moving from one place to another. *Tetrix*, however, is usually found upon *terra firma*, whilst *Membracis* seeks a more elevated field of operation among the leaves of shrubbery and small trees. Perhaps what has been said upon the subject of "Orthopterology" in this place may still be regarded as impractical and unsatisfactory without the addition of something in relation to the mode and manner of destroying the insects belonging to this order, or in some way arresting them in their works of spoliation. In that behalf most entomologists are at fault from the fact that they are not so favorably situated for testing the various remedies which have at various times been suggested as those persons are who have the greatest interest at stake, namely, agriculturists and fruit-growers. More attention of a practical character, however, is *now* given

to the transformations and economies of insects by entomologists than formerly; and in this they are also much assisted by the intelligent observations of the cultivators of the soil.

In regard to remedial agents, the first to be observed are those that exist in the economy of nature itself, because nearly all animals are preyed upon by some other larger or smaller animals. The earwigs, for instance, are preyed upon by a species of "cuckoo-fly," an insect of the order *Hymenoptera*, which, in the routine of these papers, can only be alluded to in detail in a special article on that *order*. The cockroaches are also preyed upon by the "house cricket," and by several species of *Hymenoptera*. The "leaf insects" or "walking sticks" being partial to the foliage of young trees, are preyed upon by the birds. The *Mantis* seems to be able to take care of itself, but in certain contingencies they are known to prey upon each other, which is rather unfortunate in insects that are so useful as they are in guarding vegetation from the encroachments of other insects. The crickets, grasshoppers, and locusts are preyed upon by poultry, birds, toads, lizards, and fishes; and the mole cricket is pursued underground by the common "Shrew Mole." Poultry, especially turkeys, are very fond of locusts, and pursue them perseveringly in the fields until they overtake them. Besides the enemies named, these latter insects are also infested with a species of *Acarus*, or insects nearly allied to them.* Some four or five years ago I noticed that very many of the "Spine-breasted Locusts" (*Acrydium*) were infested with small scarlet-colored parasites, (probably a species of *Acarus*,) which located themselves upon the abdomen around the base of the wings, preventing their development, and eventually destroying the insects themselves, of which I found hundreds clasped to any object that came in their way, and dead weeks before the approach of autumn.

But there are artificial means that have been at different times and in different localities resorted to for the destruction of these insects, especially the locusts and crickets. On the continent of Europe they sometimes hire children to gather the locusts and their eggs; and it is on record that in Marseilles alone, in 1825, six thousand two hundred francs were paid for destroying these insects and their eggs. It was said that an active boy could collect from thirteen to fifteen pounds of the eggs in one day.

A contrivance, operating on the principle of a "horse-rake," has also been adopted both in Europe and some parts of the United States for the capture and destruction of these insects. It is recorded in the "New England Farmer," vol. v, page 5, that a Mr. Thompson, of Epsom, New Hampshire, caught in one evening, between the hours of eight and twelve, nearly six bushels of locusts in his own and his neighbors' grain fields. The mode of gathering and destroying the locusts by this operator was by fastening two sheets together, and attaching them to a long pole, extending beyond the width of the sheets, and allowing two persons to take hold on both sides, to draw it forward. At the sides of the drag two braces extended from the pole, to raise the back part of the sheets from the ground, forming a sort of a "bag," as in a seine net, to prevent the escape of the insects. After running this drag rapidly over the ground, the braces were let down and the sheets doubled together, and the insects shook into the centre, where a secured opening was left, whence they were transferred to a bag, which, when filled, was emptied into scalding water, and thus they were destroyed. These insects in bulk weigh nearly as heavy as the same bulk of corn, and, when boiled, were fed to poultry and swine, these animals manifesting the greatest fondness for them. In this connexion I may be permitted to state that a friend who returned from California informed me that locusts were pretty extensively used as food among the different tribes of Indians when other food became scarce or

* Or perhaps belonging to the genus *Ocypete*.

failed; that the insects are deprived of their wings and feet, and then beaten into a thick batter and *baked* into a sort of cake, or perhaps more properly *fried*, for they contain considerable oil; and that these cakes are by no means unpalatable, even to more cultivated tastes. Might not these things be suggestive in an economical point of view? When the different species of crickets, grasshoppers, and locusts occur in overabundance, and are destroying the crops of our farmers, might they not be gathered and fed to those animals whose supply of food had been diminished by the presence of these destructive insects? In Africa, where the migratory locusts eat off the crops close to the very earth, they are captured in countless numbers, and furnish to the inhabitants a substitute for that food of which their presence has deprived them.

These insects mostly coming to maturity in the latter part of July, the wheat crop and the *first* grass crop generally escape their ravages altogether, but the *second* grass crop, the corn crop, and sometimes the oats and buckwheat, are seriously injured by them. It has been suggested that if all crops that *can* be were gathered before these insects reach maturity, they would be starved for want of food, and therefore their full development and procreation for a future season would be in some measure prevented, but this preventive measure should be simultaneously adopted by all in the locality where these insects, for the time being, abound. In addition to the natural means already mentioned, it may afford some consolation to the farmers and fruit-growers of our country to reflect, that often when they are deploring the presence of continuous storms and heavy rains on account of the injuries their crops may sustain from the prevalence of these sanitary visitations, there are hundreds of thousands, yea millions, of locusts and other noxious insects swept from vegetation of all kinds, and carried into brooks, creeks, and rivers, where they become food for fishes. And if, in the common destruction, a few of the useful species are included, they can well afford to part with them on account of the diminished number of the others left behind.

Doubtless it has often been noticed by the most casual observer that locusts are most heedless and impulsive in their habits when they are approached by any living object, making tremendous leaps in all directions without any regard whatever as to where they may alight, whether in fire or water, or upon *terra firma* again. When I was a boy I often amused myself by driving them into a stream just for the pleasure of seeing them devoured by the fishes, who would dart to the surface of the water to draw them under. This may also be suggestive. On one occasion, when the "red-legged locust" occurred very numerously, a gentleman near Baltimore employed his servants in driving them from his premises with long withes or switches. Now if they were driven into streams of water, in all fields bordering on streams, or having streams running through them, it might be an efficient means of destroying many of them. It is true that a number of them might be expected to reach the land again by swimming, but this would not be the case where there was a rapid descending current in the streams. It is stated by travellers that along the African coast, in their migrations, the locusts continue in one direction, and that when they come to the land's end they continue to fly on in the same direction, out into the ocean, whence they are thrown back dead upon the beach, in heaps of three or four feet in depth and for miles in length. Where fields are not margined or penetrated by streams, large fires might be kindled, and the insects be driven into them, and thus destroyed. Late fall ploughing would also turn many thousands of the eggs too deep under the soil ever to reach the surface again, and, so far, their hatching would be entirely prevented. Farmers, of course, are expected to adopt such remedies as are best adapted to their respective localities; for it must be apparent that what is applicable to one par-

ticular locality might be entirely impracticable in another differently circumstanced.

The foregoing descriptions and illustrations may present a general outline of the insects belonging to the order *Orthoptera*, and may enable the husbandman to recognize those with which he is not already familiarly acquainted, although the list of species comprises a very insignificant number of those included in this *order* of insects. The remedies, both natural and artificial, which have been merely suggested, may start the mind of the agriculturist in the right direction to discover and develope more perfect ones. Some attention to these things is absolutely necessary on the part of the tillers of the soil, if the great evils which have at various times been inflicted upon other countries are desired to be avoided, and the disproportionate increase of insect enemies prevented. This is the more essential when it is known that the insects belonging to this order go on producing one generation after another so long as the warm weather continues, and that they produce but one or two broods in certain latitudes is only because they are arrested by the intervention of an unfriendly climate, which, for the time being, stops their further progress and their increase.

ADDITIONAL OBSERVATIONS ON THE AILANTHUS SILK-WORM OF CHINA.

BY JOHN G. MORRIS, D.D., OF BALTIMORE, MARYLAND.

In the report of this department for 1861 I presented a paper on the ailanthus silk-worm of China, *(Attacus Cynthia,* Drury,) and gave the history of its introduction and acclimation in France, through the untiring efforts of that distinguished naturalist, M. Guérin de Méneville. I also illustrated its natural history, the mode of its propagation, and gave some of the favorable results of its cultivation in that country. The advantages of rearing it were stated to be, the abundance of excellent silk it furnishes, the hardiness of the worm, and its endurance of all the storms and rains of the summer unsheltered, the cheapness of its culture, requiring no house to protect it and no expensive establishment or number of hands to rear it, the facility of propagating the ailanthus on which it feeds, the two broods in one season which the animal is capable of producing, the large number of eggs which the females lay, and its freedom from the diseases which attack the common mulberry silk-worm.

This worm has now been introduced and acclimated in the United States, the credit of which is due to Doctor Thomas Stewardson, of Philadelphia. His attention was called to it by an article in the "Revue et Magazin de Zoologie," by Guérin Méneville, in which it is stated that the cultivation of this silk-worm might, unlike the mulberry worm, be successfully carried on in countries where labor was both dear and scarce and the population scattered. This statement naturally led the Doctor to hope that its cultivation might be of great value in this country. This was in the fall of 1860. He soon after received from Paris a case containing the butterfly, some cocoons, together with the manufactured silk and cloth obtained from them, which he exhibited before the Academy of Natural Sciences, of Philadelphia, in the spring of 1861. He, at the same time, gave a short account of the introduction of the animal into France, and his rea-

Plate XLVI.

BOMBYX CYNTHIA.

Ailanthus Silk Worm Moth.

sons for supposing that it might be rendered valuable in our own country, especially, if the idea of Méneville was correct, that from the character of the silk and its cheapness, it might ultimately, to a large extent, take the place of cotton.

In June, 1861, Doctor Stewardson received from Guérin Méneville six hermetically sealed tubes, containing the eggs of *A. Cynthia*. To his great disappointment, all the eggs had hatched out by the time he received and opened the tubes, and although a few worms had a feeble vitality, it was too feeble to be sustained. Fortunately, however, in a few days afterwards, another lot arrived, from which twenty living worms were obtained, which arrived at maturity and spun their cocoons. From these cocoons a second crop was obtained the same season, the butterflies being developed soon after the middle of August, (1861,) and the eggs laid by them hatched out about the first of September. From the eggs thus hatched he raised forty worms, which perfected their cocoons in his house, and from about one hundred worms placed upon a large ailanthus tree in a yard in the city he obtained eighty perfect cocoons. They were exposed during September to violent storms of wind and rain but without injury. A friend of his also raised a considerable number in the open air, but lost a great many by the depredations of birds, his situation being such and his time so occupied that he was unable to adopt any means to frighten them away.

The above experiments confirmed entirely the statement of Méneville in reference to this worm, its hardiness, the ease with which it can be raised in the open air, and, in short, every point connected with its natural history. They further establish conclusively that the worm could be easily reared in this country, and that two broods could be had in a year. The living worms and butterflies nurtured by the doctor were presented at the Academy of Natural Sciences, and the results of the expreiment there stated, and a short account of them published in the volume of Proceedings for the year 1861.

Doctor Stewardson kindly sent me about twenty cocoons in the early part of 1862. Four of them were given to a friend, from all of which butterflies were developed, having been kept in the house, and as there was a happy proportion of males and females, the product of eggs was good. The young worms, which were hatched out in ten or twelve days, were carefully nursed, and a second brood of cocoons was obtained, but the particulars of his experiments will be given in another part of this article.

My own experiments were made in the country, and strange to say, though two broods a year is the general rule, I succeeded in obtaining but one. My collaborator and I began our work at the same time, with the same family of cocoons sent by Doctor Stewardson; he raised two broods in the city, and I only one in the country. I cannot account for this remarkable fact, unless the explanation be found in our different mode and place of culture. His room in the city has a northern exposure, the windows of which he kept closed nearly all the time, but the shutters never. He fed his worms regularly with fresh leaves and took special pains in their "education," as the French happily designate it. His worms thrived well, fed voraciously and spun their cocoons at the expected time. Mine were fed in a room with an eastern exposure, the windows open all day, and owing to my absence from home from morning till evening they were sometimes neglected until my return. Besides, for two or three hours every night, kerosene oil was consumed in two large lamps, and, for the most part, there were five or six persons present in the room all day and late at night, and, above all, tobacco was smoked in the room during several hours of the day. When the family retired the shutters were closed, the apartment was tight, and not ventilated until six or seven o'clock in the morning. May not the closeness of the room and the villainous smell of the kerosene (the tobacco was fragrant!) have interfered with their development and retarded

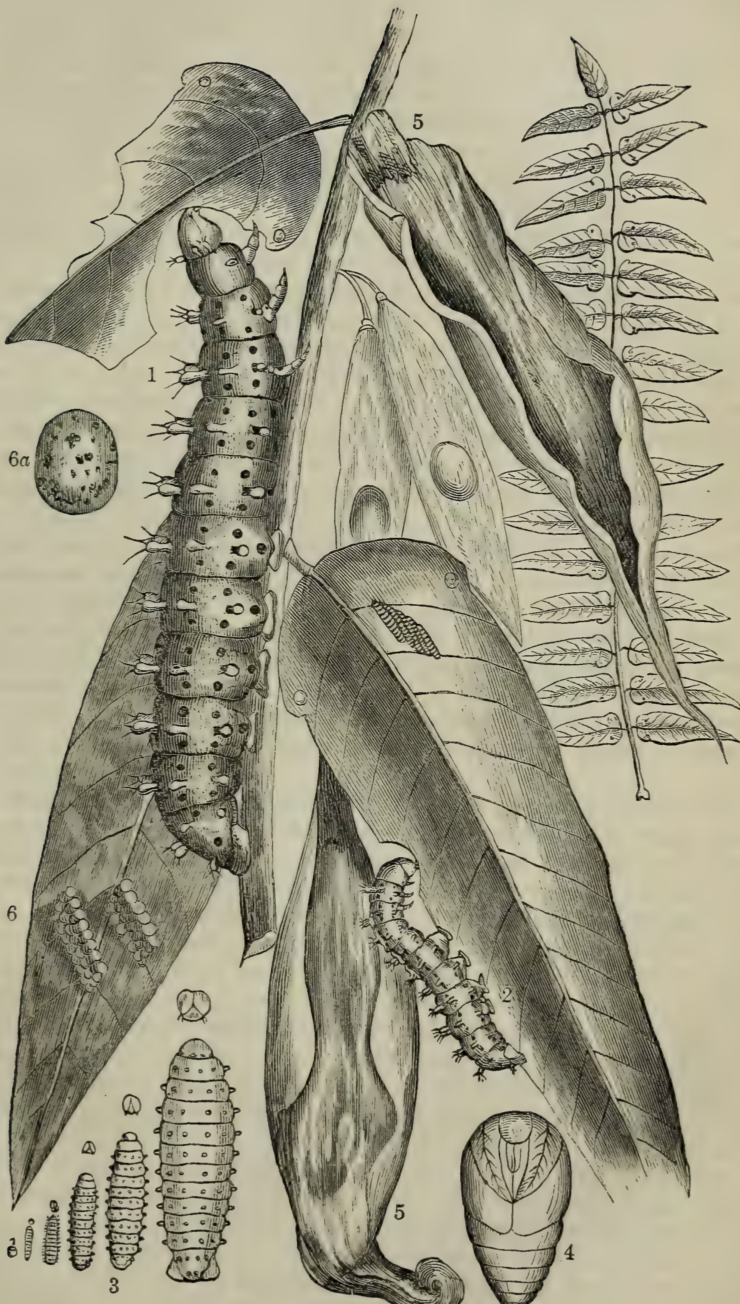
their growth? They grew slowly, a few perished, some were carried off by wasps, but the large majority spun their cocoons late in September, but not one of them developed the butterfly. Next year I shall pursue other measures, and place the worms, when eight or ten days old, in an ailanthus hedge in the open air.

It is the experience of some French cultivators of this worm that though they have got two broods, yet that *all* the cocoons of the *first* brood do not disclose the butterfly, but that six to seven per cent. pass the winter in the cocoon state. In regard to mine *not one* of the first brood has come out, but *all* are hybernating as cocoons, and instead of lamenting this fact I regard it as a wise Providence; for suppose by some casualty (and such things must be looked for in raising silkworms) the whole second brood of my friend had perished, here are mine, which I expect to be disclosed in May, to perpetuate the race and to enable us to continue our observations.

It was stated above that four of the cocoons received from Doctor Stewardson were given to a friend, who took no extraordinary pains to induce the development of the perfect insect. They were allowed to lie in a pasteboard box, which was lined with wadding on the bottom. On the 27th of June three of them disclosed the moth. These four were selected by him with a view of ascertaining whether the sexes might be known from the size and shape of the cocoon. Two smaller and narrower ones were supposed to contain males, and two rounder and stouter ones were presumed to enclose females. These suppositions were not verified. The insects disclosed were so nearly of one size as to render it very difficult to distinguish the sexes. One of the more robust cocoons had given out a male which was scarcely smaller than the female which was afterwards disclosed from the smaller and narrower cocoons. It is pretty certain that the external size, and perhaps the shape of the cocoon, depends very much upon the size, vigor, and silk-secreting power of the caterpillar, and upon the manner in which it lays hold of the leaf or other substance with which to surround itself. Some cocoons are much more loosely fabricated than others, and no decision can be rendered with certainty upon the sexes they envelope.

The first two of these four cocoons produced males, the third a female. This female, in company with the two males, was placed in a box one and a half feet broad by two feet long and one and a quarter high, covered with mosquito netting; by ten o'clock at night the most vigorous male attached himself to her and remained so until near six o'clock the next morning. During the night the female deposited her eggs in different parts of the box, in clusters of two to twenty or more, which were attached by a gummy substance that retained them firmly in their places. After the female was impregnated she became very restless, and as soon as night set in she buzzed vigorously about the box till a late hour. By the morning she had deposited the entire stock of her eggs, which amounted to two hundred and eighty; after this operation she remained quietly attached to the side of the box, but discovered considerable uneasiness when any one approached her.

The males are at all times more active than the other sex, and fight each other with their wings for the possession of the female. The distinction between the sexes may be recognized as follows: The males are usually smaller than the females; the abdomen much shorter and smaller, and conical towards the end; the antennæ are shorter and wider, and do not taper to such an acute point as in the females; the amount of white in the posterior portion of the tergum is much more considerable; the front between the eyes is much broader and shorter. The posterior wings are a little longer, and *the anal extremity* is furnished each side inferiorly with a broad lap, which is articulated, covers the genital organs, and is furnished at the lower posterior edge with two curved hooks, which, together with the other hooks around the genital pieces,



AILANTHUS SILK-WORM.

1. *Worm of full size.*
2. *Young worm.*
5. *Cocoons.*
3. *Worm in different stages from the egg.*
4. *Chrysalis as found in Cocoon.*
6. *Eggs natural size.* 6a. *Egg magnified.*

serves to secure him tightly to the female during the long process of fecundation, in which act the insects remain attached for the space of 24 hours or more. About one-third of these eggs were hatched out on the 8th of July, that is, eight days after they had been laid. They were diligently fed, and by the first of August some of them began to enter the cocoon, and by the 15th they were all enclosed.

The caterpillar, in forming its cocoon, crawls in between two leaves, or a single one if broad enough for its purpose, and gums a thread to the one side of the leaf and then towards the other for a few times, just sufficiently to hold the leaf in place and supply a sort of covering around its body; it then carries the thread along the pedicel of the leaf to its origin with the peduncle, and after drawing it over carries it back to the leaf to which it is again attached. This process is continued until the side of the pedicel is entirely covered with silk, and until the whole interior of the leaf is thickly coated. As it progresses the leaf is drawn more closely to the body of the caterpillar, so as to leave finally a neat fitting apartment in which it can lie. The silk is attached around the origin of the pedicel of the leaf to prevent it from falling to the ground.

Most of these were subsequently disclosed and went through the regular process of impregnation and of laying of eggs by the female.

I have observed that the males do not seem inclined to attach themselves to the females until late in the night.

The unimpregnated females also lay eggs, but they do not hatch and are of no use.

This insect, then, has been acclimated in our country, and I have no doubt that, with proper care, it will flourish as vigorously as in its native China. Our climate is favorable to its "education," and the ailanthus is abundant. That foreign tree now extensively disseminated, but which is exceedingly disliked by many persons owing to the unpleasant odor of its blossoms, will soon become immensely useful, for I think it likely that in a few years the ailanthus silk-worm will be generally and profitably propagated. It is true that the worm will also eat sumac, (rhus) and probably other plants of the same family, but its peculiar food is the ailanthus, and it is likely it would degenerate on any other. I well know that many persons regard, with a suspicious sneer, any silk enterprise in the United States, remembering, as many perhaps painfully do, the insane speculations in *morus multicaulis* of thirty years ago. But men need spend no money, or very little, for the ailanthus, and there is no danger of speculation in so common a plant. The seeds sown a few inches under ground in March will grow up into plants large enough for the food of the worm in a few months, or the shoots of large trees can be transplanted, which will in a short time furnish abundant leaves.

The cultivation of this worm is an employment well adapted to the poor, or the aged, or the very young, who are not capable of performing any severe labor. As the worm, from the time of its exclusion from the egg to the spinning of the cocoon, requires only about forty days at the furthest, an occasional supervision during eight days (two broods are reared) of the most pleasant season of the year, is all that is required for the production of millions of cocoons, and all this can be done by a smart child of ten years of age, or an infirm or aged person. Wherever the ailanthus can grow the worm can be reared, and even if in the extreme northern States only one brood a year can be raised, still the profits will be large enough to justify the enterprise. With no labor worth mentioning, and with no outlay of money, a textile material, holding a middle place between the silk of the mulberry worm and other materials, as wool, hemp and cotton, can be easily raised, which will prove richly remunerative in furnishing a cheap, substantial, and lasting material for apparel. The material would be cheap, and thus favorable to the poor. The coarser sorts could be manufactured into various articles of under clothing at a much less

price than is now paid for them; they are tough and strong, and will wear longer than any textile material now used. It is said that garments made of it by the Chinese last through several generations of constant wearing.

But the product is not all coarse and of inferior quality. The French manufacturers maintain that the finest stuff can be fabricated of it, as we know is done in China. It can be readily dyed in various fast colors, and can be applied to all purposes for which the mulberry silk is used. The thread is smooth, strong, lustrous and supple, and the material leaves no waste in carding or spinning. It is reasonable to presume that a tissue of such a character, so easily procured, will play an important role in our industrial pursuits. Even if it furnished nothing more than the lining of our garments, instead of the classic satin, the ephemeral character of which we all know, it would be an invaluable addition to our economic products.

Reliable estimates of the cost of raising a pound of this silk can only be proximately made, but under any circumstances it could not amount to one-fourth the cost of raising a pound of mulberry silk. The fact is it would cost nothing but a little care, and as the worm is so hardy it can be left to do its work without any particular oversight. The unwinding of the cocoons would cost a little, but this could be done by young or aged people at very little expense. The rearing of these worms, which requires no capital to begin with, would be a profitable employment to that class of the community. For the method of "education" I refer to my paper in the report of last year, (p. 374,) where full information is given.

THE MANUFACTURE OF MAPLE SUGAR.

BY C. T. ALVORD, WILMINGTON, VERMONT.

From the earliest settlement of New England to the present time the manufacture of sugar from the sap of the maple tree for domestic purposes has been carried on as one of the branches of agricultural pursuit. Although in its infancy, like many other arts pertaining to the profession of agriculture, the details of the business were but very imperfectly understood, and the different processes in the manufacture but poorly executed, in consequeuce of the lack of means to do it with, as well as the want of knowledge; yet, notwithstanding all the difficulties that had to be contended with and overcome, and the disadvantages under which the hard and sometimes severe labor had to be performed, the inhabitants in those sections of the country where the business has been pursued have been able to supply themselves from year to year with this indispensable article of food and luxury.

The improvements which have been made in the implements used in the manufacture of maple sugar, as well as the additional knowledge obtained in relation to the different processes to be performed in its manufacture, have been equally great with that of any other department of agriculture. In consequence of the additional facilities afforded, the business has increased and improved from year to year down to the present time—not only affording the manufacturer a superior article for home consumption at a very low cost, but furnishing a large quantity for sale. The demand for maple sugar has increased with the manufacture of the article, so that at the present time there is a ready market for all that is made at very remunerating prices; thus affording profitable

employment to a large portion of farmers at a season of the year when little else can be done in the other departments of farm labor, and wherever the business is extensively and skilfully carried on making it one of the largest and most profitable branches of agricultural industry.

There are, probably, but comparatively few persons, except those engaged either in the manufacture, transportation, or sale of maple sugar, who are aware of the magnitude and importance of this branch of agriculture in this country, and also that the business is carried on in so many different portions and so large a part of the United States. Although it would be difficult, and perhaps impossible, to obtain all the minor details of this department of the industry of our country, yet enough to serve our present purpose can perhaps be obtained from the reports of the seventh census, published in 1850, and the eighth in 1860. From the following statistics published in these reports we are enabled to see the amount of maple sugar and molasses made in each State and Territory of the Union:

States.	Pounds of sugar.		Gallons of molasses.	
	1850.	1860.	1850.	1860.
Alabama	643	543		
Arkansas	9, 330	3, 097		115, 673
California				
Connecticut	50, 796	44, 259	665	2, 277
Delaware			50	
Florida				
Georgia	50	991		20
Illinois	248, 904	131, 751	8, 351	21, 423
Indiana	2, 921, 192	1, 515, 594	170, 155	203, 028
Iowa	78, 407	248, 951	3, 162	97, 751
Kansas		1, 548		2
Kentucky	437, 405	380, 941	3, 077	139, 036
Louisiana	255			66, 470
Maine	93, 542	306, 742	3, 167	
Maryland	47, 740	63, 281	1, 430	2, 404
Massachusetts	795, 525	1, 006, 078	4, 693	
Michigan	2, 439, 794	2, 988, 018	19, 923	384, 521
Minnesota	2, 950	370, 947		21, 829
Mississippi		99		
Missouri	178, 910	142, 430	4, 241	18, 289
New Hampshire	1, 298, 863	2, 255, 012	9, 811	
New Jersey	2, 197	3, 455	954	8, 088
New York	10, 357, 487	10, 816, 458	56, 547	131, 841
North Carolina	27. 932	30, 845	514	17, 759
Ohio	4, 588, 209	3, 323, 942	197, 298	392, 932
Oregon				
Pennsylvania	2, 326, 525	2, 768, 965	50, 711	127, 455
Rhode Island	28		4	5
South Carolina	200	205		
Tennessee	158, 557	117, 359	7, 223	6, 754
Texas		69		3, 608
Vermont	6, 349, 357	9, 819, 939	5, 988	
Virginia	1, 227, 665	937. 643	40, 322	100, 139
Wisconsin	610, 976	1, 584, 406	9, 874	83, 003
Total	34, 253, 436	38, 863, 568	598, 160	1, 944, 299

From the above table it will be seen that maple sugar is made in twenty-eight States and maple molasses in twenty-three. The State of New York makes the most sugar, and Rhode Island the least. Ohio makes the most molasses, and Rhode Island the least

This report of the maple molasses crop is evidently incorrect, as no returns are given from the States of Maine, Massachusetts, New Hampshire, and Vermont. In the report of the seventh census the returns of maple molasses from these States were as follows: Maine, 3,167 gallons; Massachusetts, 4,693 gallons; New Hampshire, 9,811 gallons; and Vermont, 5,988 gallons—making, in the aggregate, 23,659 gallons. If the ratio of increase in the quantity of molasses is the same as that of sugar in these States from 1850 to 1860, the amount of molasses would be nearly double what it was in 1850, which would make the amount for these States, for 1860, about 46,000 gallons, making the aggregate amount 1,990,594 gallons. From these reports it will be seen that the excess of maple sugar made in 1860, over that in 1850, amounted to 4,610,132 pounds, and the excess of molasses 1,346,139 gallons.

Of the increase in the amount of sugar made in the time mentioned, the Superintendent of the Census says:

"The increase is not large, but sufficient to afford gratifying evidence that our beautiful maple groves and forests are not becoming extinct, while many are preserved with commendable care. We wish it could, with truth, be added that the cultivation of this noble tree was extending in a ratio equal to that wherein the old trees in the forest are diminishing under bad treatment and the demands for new land for tillage. The land-holder who appropriates a few rods of land to the preservation or cultivation of the sugar tree not only increases the value of his estate, but confers a benefit upon future generations."

It will be noticed that the proportional increase in the quantity of maple molasses manufactured in 1860 over that of 1850 is much larger than that of maple sugar. I attribute this to the fact that many farmers are now making "maple sirup" to sell, instead of maple sugar. At present prices it is thought to be more profitable to make sirup than sugar.

A few figures will show the magnitude and importance of the maple sugar crop of any town in Vermont, where maple sugar is manufactured, and the important influence it has on the wealth and prosperity of the inhabitants; the same results extended to counties, states, and the nation, will show corresponding influences and bearings on the wealth and prosperity of larger communities. Take, for example, the town of Wilmington. Calling the amount of sugar annually made in this town 200,000 pounds, it will furnish to each inhabitant 140 pounds. Divide it among the fourteen school districts, and it will give about 14,000 pounds to each district. Reckoning the price of sugar at nine cents per pound, it will amount to $18,000 for the town; this, divided among the school districts, would give about $1,285 to each district, or nearly $14 to each inhabitant of the town. From the foregoing estimates, it will be seen that in all those towns where maple sugar is or can be manufactured, the inhabitants have a reliable and unfailing source from which to obtain a supply of sugar for their own consumption and a surplus to spare. Should it be expedient or necessary, the amount of sugar annually made could be largely increased, as the sugar orchards on many of the farms have not been fully worked. This is probably true of most places, especially in those towns where the later improvements in the manufacture of sugar have not been introduced. The ready sale of maple sugar for a few years past, and the prices which it has brought, I think, are sufficient inducements for all, who have the opportunity for doing so, to engage in the manufacture of this article, and thereby add to the wealth of the country and to the amount of their individual incomes. The maple sugar crop in any section of the country where successfully manufactured is one of the most profitable crops made, and there is probably no branch of the farmer's business that affords as much income and clear profit according to the amount of capital invested and labor expended.

The art of manufacturing maple sugar, in its infancy, in New England, like many other arts pertaining to agriculture, was but imperfectly understood; and in consequence of the lack of means among a large portion of the inhabitants the business was performed in a primitive manner. To a

person accustomed to manufacture maple sugar with all the conveniences and improvements of the present day, it would seem almost impossible to produce the article with the rough and uncouth-looking implements and the scanty and inferior accommodations which our forefathers used. Yet with industry and perseverance they accomplished, in a limited manner, what those of the present day perform on a larger scale.

It will, perhaps, be interesting and instructive to notice the main features of the business as performed by the early settlers of New England, in connexion with the implements used in the prosecution of the work; also to glance at some of the improvements subsequently introduced in carrying on the business, and to speak of the business, as now conducted in this vicinity, with such improvements as have been introduced and successfully used at the present time.

We will suppose that one of the early settlers, a farmer, is going to engage in making maple sugar, he would commence operations in something like the following manner: The first thing to be done is to procure something in which to catch the sap, and just before the season for making sugar arrives, he takes his axe, goes into the woods where the work is to be done, and proceeds to make a sufficient quantity of troughs. These are generally made out of soft timber, such as will split freely and work easily; trees of about one foot in diameter are selected and cut into lengths of from two and a half to three feet; these are split through the centre, and the blocks thus made are dug out with the axe, and made large enough to hold from one to two pails of sap. He next wants some spouts to conduct the sap from the tree to the trough; these are made of some timber that splits well, and are made by cutting or sawing blocks one foot in length, and splitting them into thin, narrow staves. If a crooked "frow" can be obtained to split them with, they are of the desired form; but if they have to be split with an axe, as is frequently the case, then a shallow groove has to be cut on one side for the sap to run in; one end of the spout is sharpened to correspond with the shape of the tapping iron. This instrument is about one foot in length, and made of iron in the shape of a carpenter's gouge, the cutting end being about two inches wide and usually made of steel.

When the sap will run, the trees are tapped by making two incisions on the body of the tree, near the ground (or as near as the snow will admit;) these incisions are made in the form of the letter V; just below the point of these cuts, another is made with the tapping iron by driving it into the tree with the axe, and into this the sharpened end of the spout is driven, and under this spout a trough is placed to catch the sap. Previous to tapping the trees, a place is prepared to boil the sap; this is done by felling a large hard wood tree; from the butt end two logs are cut, the length of these depending on the number of kettles to be used. If only two are used, they would be about six feet long. These logs are placed on the ground parallel with each other, with a space between them wide enough to hang the kettles. At each end of the logs a crotched stick is set into the ground, and across these a pole is laid; from this pole the kettles are suspended. These are generally iron, and hold from twelve to fifteen gallons. In boiling the sap, when the logs are burned up, others are cut from the same tree and rolled up to supply their places. If the tree did not supply logs enough for the season, and others could not be brought conveniently to the fire, a tree was cut in another place and the boiling place removed. It was usually the custom, however, when it was desirable to have a permanent boiling place, to go in the fall or winter previous and cut and pile logs enough near the boiling place to last through the season; sometimes wood was cut and piled ready for use, but generally the wood used was green, and cut from day to day as it was wanted. The sap was gathered and carried to the

boiling place in buckets or pails suspended from the ends of a wooden yoke, made to fit the shoulders of the person who gathered the sap.

In gathering sap when the snow was deep, unless paths were made to go in, it was necessary to use snow-shoes to go around on the snow. Generally a rude shanty was erected near the boiling place, under which the tools that were used and sometimes a little dry wood were placed, and into which the man himself could also go when occasion required.

Our fathers had but limited means for storing the sap when gathered; and during a *good run* much of it would be wasted, and during stormy weather much snow and rain would get into the sap. In boiling sap in kettles hung between logs, the wood to make the fire with had to be set endwise between the logs and kettles, and as the lower ends burned off, the tops of the small sticks would frequently fall into the kettles; leaves and ashes would occasionally be blown in by the wind; and when the sap was nearly boiled down to sirup, it would burn on the sides of the kettles, thus giving the contents of the kettles an additional color. What the precise quality or complexion of the article thus made was, I shall leave the reader to imagine. In some instances the sirup was strained through *hemlock boughs*, and then boiled down to sugar, if a mixture made by boiling such a compound together could be called by that name.

Those who wished to make a nice article would strain the sirup through a linen strainer, then clarify it with milk or eggs, then strain it again and boil it to sugar. In this way a much better article of sugar was made than one would suppose. At the close of the season the troughs were turned bottom upwards by the tree, or set endwise against it, where they were ready for use next spring. The spouts were taken from the trees, and, with the kettles and other tools, carried to the dwelling-house of the owner for future use.

After a series of years wooden buckets began to be used in the place of troughs, and instead of tapping the tree with the axe and tapping iron, an auger was used. The trees were tapped by boring a hole into the tree from one to two inches in depth, and short, round spouts driven into the holes; an iron spike was driven into the tree a few inches below the spouts, on which the bucket was hung by means of a hole bored through one of the staves near the top.

A cauldron kettle was substituted for boiling the sap, and this large kettle was hung up to one end of a long pole resting on a crotched stick set in the ground; this pole was so balanced that when the kettle was filled with sap, the other end of the pole would rise and let the kettle down to the fire; but when the sap was boiled down low, the kettle would rise out of the way of the fire. The advantage of having it hung in this way was, that much less of foreign substances got into the sap while it was boiling; and if the person who was boiling the sap should be absent from the fire for some time, and the sap get low, it would swing up from the fire, and thus prevent it from being burned.

After this, those who had cauldron kettles began to set them in arches made of stone, and these arches were generally protected from the storm by a shelter of some kind, at the same time the wood for boiling the sap was cut the season before it was wanted for use, so that it would be dry when wanted. Those persons having sugar lots near their dwelling-houses, accessible to a team, and having conveniences at their dwellings for boiling sap, drew it and boiled it there; the sap was gathered and put in barrels, and drawn on sleds to the boiling place.

Soon after this, as there began to be a market for maple sugar, those engaged in the business began to build permanent houses and enlarge their accommodations and facilities for manufacturing. These sugar houses are generally built on the sugar lot, and were made large enough to contain the boiling fix-

tures, the storage for sap, the sap buckets when not in use, and generally the wood to be used.

These improvements in the manufacture of maple sugar which have been mentioned would bring us down to about twenty-five years ago in this part of the country, at which time considerable attention had been given to the business, both in the manufacture of the sugar and the preparation of it for market. About this time sheet iron pans began to be used for boiling sap, and from thence a new era seems to have commenced in the business. It was soon ascertained that those who used these pans for making sugar obtained a much better article than those who used iron kettles, and that those who made the best sugar sold it for the highest price; and that while there were generally plenty of customers for a good article, it was often difficult to dispose of an inferior one at paying prices. These considerations, with the increasing demand for maple sugar, have stimulated those engaged in the manufacture to make all the improvements that were possible, so as to produce a superior article at the least expense and with the least labor.

The most approved way of building sugar houses now, in this vicinity, is to locate them so that the ground on one side of the house will be several feet higher than on the opposite side. The general plan of the house and fixtures for boiling and storing the sap is as follows: The house is made large enough to enclose the arch and store-tubs at one end, with the wood in the other end, and the sap buckets in the upper part. The arch is built near one side of the house, and on the opposite side is built a platform on which the store-tubs are placed. These tubs are so arranged that the sap can be drawn by means of a faucet in the bottom of the tubs into a spout, and run into the heater or pans. On the outside of the building the ground is fitted at such a height that the sap can be drawn from the bottom of the gathering-tubs and run into the tops of the store-tubs. With this arrangement all the labor of lifting the sap after it is placed in the gathering-tubs or buckets and brought to the house is avoided; the only force used after this until the sap is in the pans is that of gravitation. In the sides of the building are doors, so calculated as to afford means for the steam from the boiling sap to pass off. The arches are generally built of brick, though where suitable stone can be obtained it is sometimes used. The arch is usually made wide enough to set on one pan and long enough to place one or two pans, as may be required, and a heater. The pans to be set first from the mouth of the arch, and the heater between the pan and chimney. The mouth of the arch is fitted with a cast iron frame and door. About eight inches from the bottom of the arch is a bed on which the fire is made; this floor is generally made of narrow, flat stones, with sufficient space between them for the coals and ashes to fall through into the lower part, and thus prevent the fireplace from getting clogged up, as it would do in boiling any length of time without the floor. In this arrangement of the floor, the draught of air passes under and up through the fire, throwing the flame and heat of the fire against the bottom of the pans. The pans are generally set directly on the top of the arch, which is made level and smooth for that purpose. The ends of the pans rest on iron castings made for that purpose. On the end of the arch where the heater is placed is fitted a cast iron frame, in which the heater sets.

The pans for boiling the sap are made of Russia sheet iron, and are of different sizes, holding from one to four barrels. The size of a pan holding one barrel is two feet three inches long, and two feet wide on the bottom; a two-barrel pan, five feet five inches long and two feet wide; a three-barrel pan, five feet four inches long, three feet three inches wide; a one and a half barrel pan, four feet four inches long, and two feet wide. The depth of the pans is seven and a half inches. The sides of the pans usually flare about three inches on a side, which would make the top of the pan six inches wider than the bottom.

Handles are placed on the sides of the pans near the the top. The cost of the pans will vary with the price of iron and also the quality of the stock; at present the cost is from eighteen to twenty-five cents per pound after the pan is finished.

The sap-heater is a modern improvement; the kind used in this vicinity was invented by a man in this town about fourteen years ago. The first heater that was made has been used every year from that time to the present, and apparently will last as much longer. Experience in the process of boiling sap has shown that whatever vessel is used, the larger the surface exposed to the fire the faster will evaporation take place, and that evaporation will proceed faster in shallow vessels than in deep ones; and on this principle the sheet-iron pan has been constructed. In the construction of the sap-heater the idea was to make a vessel in which a much larger surface of the vessel, and, consequently, the sap, would be exposed to the fire than was in the pan then in use. To accomplish this it was proposed to incorporate into a sap-pan the principle, and, as far as practicable, the form, of a high-pressure steam-engine. (I have been informed by those acquainted with the construction of the engine that this has been accomplished to a certain extent.) The plan adopted was to make a pan, with a box or pit extending down from the bottom of the pan. Into this box were placed a number of tubes; the ends of tubes to be made tight to the sides of the pit, and holes cut through the sides of the pit against the ends of the tubes. In making the pit the holes are first made in the sides; then the tubes fitted in. When the pan was placed on the arch the pit of tubes would be placed in such a position that the heat and smoke of the fire should pass through these tubes, thus exposing a very large surface to the action of the fire, and, consequently, when the vacant places between the tubes were filled with sap, a very rapid evaporation must take place. Another consideration in the use of the heater is, that no additional fuel or heat is required; the heater, being placed in the arch behind the pans, receives the heat from the fire after it passes from the pans, so that all that is accomplished in boiling with the heater is a clear gain in time and fuel. In using the heater it was found necessary to have the top part of it made high, to prevent the sap running over when boiling; for when the fires are hot the heater is filled with foaming sap. Even with the high top it is necessary to have one or two tubes or spouts in the side near the top, to let the boiling sap into the pan before it, and also to make the system of boiling arrangements complete, which will be examined hereafter.

The sap-heater is made of the best quality of tin; the usual size is as follows: The upper part is $19\frac{3}{4}$ by $13\frac{1}{4}$ inches wide on the sides at the bottom, and 18 inches high; the sides flare about two inches, so that the top is about four inches wider than the bottom. The pit is $12\frac{1}{2}$ inches deep. The tubes are $13\frac{1}{2}$ inches long, and $1\frac{3}{4}$ inch in diameter. A pit of this size will contain thirty-five tubes, placed in five rows, seven tubes in a row. Near the top of the heater, on the side next to the pan, one or two tubes are placed to carry the sap from the heater to the pan. On the sides of the heater, at the top, are handles for taking it off. The cost of the heater is from eight to fourteen dollars, according to the size. The method of taking off the heater is to have a windlass directly over it. When the heater is not in use in boiling sap, a piece of sheet or cast iron is used to cover the place in which it sets. To remove the pans from the arch when they contain hot sap or sirup various ways are used. The simplest and safest way that I have tried is to have a strip of board nailed to the studs on the side of the house, the top edge of the board level with the top of the arch; then have two strips of board just long enough to reach from the side of the house to the bottom of the pan on the arch; have the upper side of the ends of the boards next to the pan bevelled off to an edge; place these near the ends of the pan. After most of the sirup has been dipped

out of the pan, stand at the side of the arch between these boards; take hold of the handles of the pan and draw it upon the boards, where it can be emptied of the rest of the sirup. The plan for boiling sap in the arrangement just described is, after the sap has commenced boiling, to have a stream of sap running into the heater, and from the heater into the pan before it, in which it is boiled down to sirup. If two pans are used, the sap is dipped from one to the other.

The quantity of sap which can be boiled in a given time depends on many circumstances. Sap will boil much faster on a clear day than on a cloudy or stormy one, and weak sap will boil away faster than that which is stronger. With a three-barrel pan and a heater, with good wood and favorable weather, sap enough for eighty pounds of sugar can be boiled in a day as an average day's work. The kind of wood used may be either hard or soft, though it is now thought that equal parts of both kinds, mixed together, are the most economical. With one pan and heater the wood should not be cut over three feet long; some think two feet long enough. If the wood is too long it will clog up the back part of the arch with coals, so that the heater will not work as well. My own opinion is, that one cord of wood, (running measure,) two feet long, will boil as much sap as a cord four feet long. One cord of wood, two or three feet long, is calculated to make one hundred pounds of sugar.

The buckets used to catch the sap are made both of wood and tin, the wooden ones being generally used. These are made of pine lumber, hooped with iron, and painted with oil paint on both sides; at the top of the bucket, on the outside, is an ear made of sheet iron, through which is a hole large enough for the spike to pass on which it is hung. These buckets are made at factories, and cost from ten to twelve dollars a hundred, and will hold about ten quarts each. Tin buckets can be obtained at the tin shops, and will cost from twenty-five to thirty-eight cents each. The spouts used for conveying the sap from the tree to the bucket are principally made of wood, although metallic ones are used to some extent. The wooden spouts are made of hard wood, birch making the best. They are made by taking inch boards, sawing them into strips one inch wide, then cut into pieces the length of the spout, which is about six inches; these are then put into a lathe and turned round and smooth, one end of which is tapered down to a little less than half an inch in diameter; a hole about one-fourth of an inch is then bored through the entire length, and the spout is ready for use. These cost thirty-four cents per hundred. The spikes for hanging the bucket on the tree are made of wrought iron, and are about two inches in length, with the head on one side of the nail, to prevent the bucket from slipping off. The present cost is about forty cents per hundred. A common half-inch bit is used for tapping the tree, though many use one seven-sixteenths of an inch for that purpose, and a one-half inch bit for boring the second time.

In all sugar lots, where the surface of the land will admit of a team being used, the sap is drawn from the different parts of the lot to the sugar house, on sleds, by oxen. For this purpose a gathering-tub, holding three or four barrels, is used. This tub is made with a head in both ends, the diameter of the bottom being much larger than the top, to prevent it from tipping when filled. In the top of the tub a hole is cut large enough to turn in the sap; a lid is made to fit this hole, so that when the tub is full it can be closed tight, to prevent the sap from being wasted in going to the house. The tub is fastened on the sled with stakes or chains.

The tubs in the house for storing are usually about the size of the gathering-tubs; they have but one head, and the tops of these are the largest. Both the gathering and storing tubs are made of spruce or pine boards, hooped with iron, and usually painted on the outside. The storing-tubs should be painted

on the inside like the buckets, to prevent them from becoming sour and discolored with mildew.

Whenever storing tubs or buckets become sour, they should be immediately washed clean before putting more sap in them. In those lots where a team cannot be used to draw the sap, a hand-sled can be frequently used with advantage. Many of the sugar lots are located on the sides of hills so steep that neither teams nor hand-sleds can be used to draw the sap. In these lots leading spouts can be used in a way to save much severe labor. By having the sugar house located at the lowest part of the lot, lines of leading spouts can be put up from the house to different parts of the lot, and in these spouts the sap can be run from those places to the house. The first kind of spouts used was made of wood in the following manner: Spruce logs were sawed into scantling 2½ by 3 inches square, from 14 to 16 feet long; on one side of these sticks a groove was cut sufficiently deep for the sap to run; this groove is cut with a shaving or drawing knife made in the shape required. The ends of the spouts are made so that the end of one spout will lap over the other, and are fitted to match so that the sap will not leak at the joints. In the autumn, before the snow falls or the ground freezes, stakes should be set in lines as near straight as possible, extending from the sugar house to those parts of the lot from where the sap is to be brought. The distance between these stakes should be a little less than the length of the spouts. Into these stakes pins should be put for the spouts to rest on, and the pins should be so placed as to make the line of ascent a gradual one. In the spring, when the spouts are wanted for use, they are put up and remain through the sugar season, when they should be taken down and housed in a dry place. In places that are much exposed to the wind the spouts should be fastened to the stakes, to prevent them from being blown down. These spouts cannot be used when it snows, as the snow that falls into them will choke up the passage of the sap, so that it will run over and waste. In rainy weather considerable water will collect in the spouts if the line of spouts is a long one; but, by taking advantage of the weather these inconveniences can generally be avoided. At the upper end of the line of spouts a store-tub is placed; by means of a faucet the sap is drawn into the spouts, and the size of the stream gauged to their capacity. The tin leading spout, lately introduced in this vicinity, is a great improvement on the wooden spout. It can be used as well in stormy as in pleasant weather. It is made in the form of a tube or pipe, in lengths of eight feet. The size of the tube generally made is one-half inch, and costs thirty-seven cents per rod; one end of these spouts is made a little larger than the other, so that the ends will fit tight in putting them up.

The time for making sugar varies with the season. Some years I have known the sugar season to commence the last of February, and in others not till the first of April. The usual time, in this vicinity, is about the 10th of March, and generally lasts about six weeks. The method of tapping the trees is to bore the holes into the tree about one and a half inch deep, having the holes several inches apart. In large first-growth trees, two and sometimes more spouts are put into a tree. In second-growth trees, two spouts in the larger ones and one in the smaller ones is sufficient.

The quantity of sap which different trees produce varies largely; some will produce as many pailsful as others do quarts. As a general rule, second-growth trees that have the most top will produce the most sap; with first-growth trees the difference is not as great. Trees standing in open land will produce much more sap than those growing where the timber is thick. Sap varies much in saccharine strength. Trees growing in open fields, or in exposed places produce a sweeter sap than those growing in the forest. Some years the sap will produce much more sugar than in others. Taking one year with another, eight pounds of sugar to a barrel of sap is a good average yield. It has been

calculated that sap requires to be reduced to about one-twentieth of its bulk, to form good sirup.

In making maple sugar or molasses, one thing is indispensably necessary in order to make a good article; that is, *cleanliness* in every process from the time the sap is collected till it is made into sugar. Great care should be taken that all the implements used to hold the sap or sirup should be kept *clean* and *sweet.* The same care should be taken to prevent all foreign substances, such as bark, leaves, and dirt, from getting into the sap, and also to remove them as soon as possible, whenever they do get in, as everything of this nature has a tendency to impart a dark color and also an unpleasant flavor to the sugar. Sap usually runs best in pleasant weather, when the air is clear and wind west—an easterly wind dries up the sap—but at this season of the year, changes of weather and storms are frequent, and if it can be avoided, sap should not remain out to be exposed to the storm, as water from any source injures the quality of the sugar. Experience has shown that the sooner the sap is converted into sugar after it leaves the tree, the better; and especially is this the case when the weather grows warm; for the sap is liable to *sour* in the buckets, and also in the store-tubs. When the weather is quite warm—as it sometimes is for a day or two—sap will sour in twenty-four hours. At such times the boiling should be forced to the utmost extent, night and day, if necessary. At no time should much sap be allowed to accumulate on hand, if it can possibly be avoided. After the sap has been gathered, if there is dirt in it without ice, it may be strained as it runs into the pans. After the boiling has commenced, it should be kept up without cessation until it is reduced to sirup. Twelve hours is long enough to boil at one time for siruping off. The sirup should be boiled down as thick as it can be strained when taken from the fire. Whatever dirt and scum arises on the surface of the sap when boiling should be removed with a skimmer. As soon as the sirup is taken from the fire, it should be strained into a tub used for that purpose, and allowed to settle. The best strainers are made of home-made flannel—one thickness of cloth answering for a strainer.

After the sirup has settled, it should be made into sugar. Pour off that part which is clear into the pan or kettle to be used in boiling it, leaving the sediment in the tub. By turning some hot sap into this it can be settled again, and either boiled down by itself or with the next lot of sirup. It was formerly the practice to clarify the sirup with milk or eggs, to remove the impurities; but if the sirup be well settled it needs none, for the simple reason that there are no impurities to remove. After the sirup is placed on the fire it should be kept boiling with a steady fire until it is done. Sometimes, while boiling, it is inclined to run over. To prevent this, put a piece of butter the size of a marble into it, and sometimes it may be necessary to put in a second or third piece before it will settle. A very good way is to take a stick long enough to reach across the vessel; lay this stick across the top of it, and from the stick suspend a piece of fat pork; when the sirup rises against the pork, it has the same effect as the butter. If neither of these methods will prevent the sirup from running over, the heat of the fire must be reduced until it boils steadily.

The degree of hardness to which the sugar needs to be boiled depends on the subsequent treatment. If it is to be put into tubs and drained, it should be boiled only enough to have it granulate readily; if it is to be put into cakes, it should be done so hard that it will not drain at all; it is necessary to boil it as long as it can and not burn. There are various ways of telling when the sugar is boiled enough. A convenient and good way is, when snow can be obtained, to have a dish of snow, and when some of the hot sugar is put on the snow, if it does not run into the snow, but cools in the form of wax on the surface of the snow, it is done enough to put into tubs to drain. But when it is to be caked or stirred, it should be boiled until, when it is cooled on the snow, it will break like ice or glass. When snow cannot be obtained, stir some of the sugar in a

dish, and as soon as it will granulate, it is done enough to drain; when it will form *bubbles, feathers,* or *ribbons,* on being blown, it is done enough to cake or stir. To try it in this way, take a small wire or stick and form one end into a loop; dip this loop into the sugar and blow through it to produce the forms described. When the sugar is done it should be taken from the fire immediately, and cooled. It is then ready to be put up in any way that may be wanted. In large places, or where large quantities of sugar are made and the sirup is sugared off at the sugar house, a one-barrel pan fitted to a small arch is used to make the sugar in; but when the sugaring-off is done on the stoves of the dwelling-houses, as large quantities of it are, smaller pans or brass kettles are used. These pans are made of sheet-iron, tin, and copper: a convenient size is one of twenty-two inches long by thirteen wide on the bottom, and thirteen inches high, with handles on the ends. From forty to fifty pounds of sugar can be made in a pan of this description. The general method of putting up maple sugar for family use is to place it in tubs and drain it. When put up in this way, the sugar should stand long enough after it is taken from the fire to become well crystallized before it is put into the tubs. The best tubs for this purpose are those holding from one to two hundred pounds, made flaring, largest at the top, and having two bottoms. There should be a space of several inches between the bottoms, to contain the molasses which drains from the sugar. The upper bottom should be fitted loose, so that it can be taken out when the tub is empty. In this bottom one or more holes should be made for the molasses to drain through. When the tubs are to be filled with sugar, this hole should be stopped with a stick long enough to reach above the top of the tub. After the first batch of sugar put into the tub has become hard, the stick should be loosened and raised a little, and this process continued until the tub is filled. The molasses will drain through this hole into the receptacle below the sugar, where it is secure from dust and insects, and when wanted for use it can be drawn out by means of a faucet in the side of the tub.

Many families are in the habit of stirring a portion of their sugar, as in this form it retains its flavor better than when it is drained, and is in a more convenient form for use. When the sugar is to be stirred it should be boiled hard enough to cake. When it is done, take it from the fire, set the pan in a cool place, and with a wooden paddle commence stirring it briskly, and continue to do so until the sugar is grained and dry, or of the consistency of the brown cane sugars. If it is then put into tight boxes or tubs and thus kept, it will retain the fresh maple flavor for some length of time.

When the sugar is to be caked, it should be allowed to stand after it is taken from the fire until it is partially grained, when it should be run into the moulds. Care should be taken not to let it get too cold before it is put into the moulds, for it hardens so fast at this stage that it must be handled quickly in order to cake in good form. If it is desirable to have the sugar of a coarse grain, it should not be stirred while it is chrystallizing; but if a finer grain is wanted, by stirring it moderately while cooling, any desired grain can be obtained. Both wooden and tin moulds are used to cake sugar in, and these are made of different forms and sizes—the weight of the cakes varying from two ounces to several pounds. The general form of the cake is a square, as this is the most convenient one for packing in boxes, in which form it is put up for market. Previous to putting the sugar into moulds, they should be wet with water as this prevents the cakes from sticking. After the sugar is removed from the moulds, they should be washed before they are filled again.

In draining sugar most of the coloring matter can be taken out and a white sugar obtained; but in this process much of the maple flavor is lost. The method is to cover the top of the sugar with wet cloths, flannel generally being used. These cloths should be wet and washed daily in cold water until they are removed from the sugar

Within a few years the manufacturers of maple sugar in this vicinity have been, to some extent, making maple sirup or molasses for sale instead of sugar. Where it can be sold in this form it saves much labor that is required to make it into sugar. The sirup is put into wooden kegs holding several gallons each, and tin cans holding from one to four gallons each. These cans, after they are filled, are sealed up air-tight, so that the sirup will retain its flavor for some length of time and they can be safely transported to any part of the country.

It will perhaps be unnecessary in this place to speak of the various purposes to which maple sugar and molasses are applied, unless to those who are unacquainted with the article, and to that class of people it will be sufficient to say, that for any domestic purpose for which cane sugar or molasses is used, maple sugar and molasses can be substituted, and in all places where they are to be used in the raw state, I think the maple sugar or sirup is decidedly superior to that of the cane.

In the present complicated state of our national affairs the manufacture and production of maple sugar is a subject which commends itself to the consideration of every one having the facilities for engaging in this branch of business. The present high prices of sugar, if no other consideration was taken into account, are sufficient to induce those engaged in the business to enlarge and extend their operations as far as their means will allow, and also to stimulate others not now engaged in the business to improve those opportunities which they may have of increasing the amount of sugar made, both with profit to themselves and benefit to others.

Aside from the present pecuniary inducements to engage in the business there is another aspect in which it should be viewed, and that is, the relation which it bears to the prosperity of those States in which the business is prosecuted, and to the nation at large. It should be the aim and effort of every individual to develop and bring into successful operation all those industrial pursuits which tend to make our country prosperous and independent of other nations.

At the present time, while our nation is engaged in the great and momentous struggle for the maintenance of its independence and the restoration of its prosperity; while the means and energies of all classes are taxed so severely for its successful prosecution, it is a sacred duty which we owe to ourselves and to our country to exert every energy to the utmost, in whatever department of agricultural industry we are engaged, to produce and furnish all those indispensable articles of food which we need, and thereby do all in our power to restore our country to its former independence and secure its future happiness and prosperity.

FLAX-COTTON;

ITS ADAPTATION TO COTTON MACHINERY.

BY HON. CHARLES JACKSON, PROVIDENCE, RHODE ISLAND.

THE very elaborate and lengthy papers of Mr. Browne and Mr. Leavitt on the history, culture, and manufacture of flax, appended to the able report of the Commissioner of Patents for the year 1861, preclude the necessity, at this time, of further inquiry into those important branches of the subject.

It is proposed to make this paper very brief, and confine it mainly to the

inquiry whether or not *flax fibre* can, by mechanical, chemical, or other means, be converted into *flax-cotton* of a suitable quality for use as a *substitute for cotton in the cotton-mills* of our country. The vast amount of capital invested in the mills, (nearly $100,000,000,) the absolute necessity of production to meet the wants of consumers, the dependence of the loyal portion of the country upon the disloyal portion for the staple to insure that production, the amazingly increased value of the staple, and the uncertainty of a supply at any price, all give this question of *substitution* the strongest claim upon the attention of the people and the government. That this claim will be favorably recognized by the government in the present crisis of our national affairs can hardly be doubted.

No opposition to the enterprise can arise from capital invested in flax-mills similar to the flax-mills of Ireland and Great Britain, for we have comparatively no such investments. This is a most singular fact in our industrial history, considering the adaptation of our country to the culture of flax, the abundance of our capital, the inventive and enterprising character of our people, and our immense consumption of flax products. But such is the fact, notwithstanding that in Ireland, as early as 1856, there were not less than 100 flax-mills, with 560,000 spindles, 50,000 operatives, and $20,000,000 of capital; and in Great Britain, at the same time, not less than 300 flax-mills, with 700,000 spindles, 7,000 power looms, and $30,000,000 of capital, while in this country, even at the present day, there are not more than 15,000 flax-spindles, and those are mostly employed in spinning flax-yarn of the coarsest kind.

The question is not, however, whether mills shall be built here after the Irish and British models for the manufacture of flax-yarn and linen goods, but whether or not flax can be so treated as to be available for the manufacture of those staples on the machinery of our cotton-mills; and, if so, whether the substitution can be accomplished economically, and on a scale commensurate with the wants of the mills. Both phases of the inquiry being equally important, they will be examined briefly in detail. It is generally known that flax and cotton are handled in a similar manner, preparatory to the spinning process, *i. e.*, they are first made to assume the form of drawing and roving, and also that they are both spun from rolls moving at different speeds to reduce the rovings to a suitable fineness for the yarn, and that the rolls are located at proper distances from each other, to suit the lengths of the two kinds of fibres. These mechanical analogies seem to favor, at the outset, the substitution of flax for cotton. They should not be overlooked. Neither should corresponding analogies (if there be any) between cotton and flax, in their natural state. Do any analogies of the latter kind exist? Cotton consists of cylindrical fibres, individualized and separated in the bolls of the plants during the ripening process. The fibres when first developed are in a milky or glutinous state. As the bolls open under the influence of the sun and air the moisture evaporates, and the fibres begin to assume their distinctive character, until they are finally separated from each other and *cohere* only to the seeds, which they partially envelop. In this liberated form they are characterized by uniformity in length, firmness, and strength, and by a slightly spiral or bearded surface, which fits them for uniting equably during the carding, drawing, roving, and spinning operations.

But cotton, as sold in the market and worked by manufacturers, has not, throughout its bulk, the characteristics of uniformity in length and strength. The different pickings from the fields frequently vary the character of the fibres. A drouth or a frost, by suspending their growth, shortens their length and weakens their strength, and, as the pickings are usually ginned promiscuously, the result is a variation in the fibres of all cotton on the market, in both these respects. These variations, however, are always attended with one

marked peculiarity, *i. e.*, with *uniformity in length* of a large proportion of all the fibres as a *maximum* length. Sound gulf cotton has the maximum number of its fibres, about seven-eighths of an inch in length; uplands, about six-eighths of an inch. The greater or less percentage of this maximum length of fibre, with the other properties of fineness, strength, and cleanness, give the grade of cotton. When cotton is disproportionately short and weak, it is undesirable, because the fibres, in the process of manufacturing, fly off in the form of waste. But short and weak fibres, in small quantities, interspersed and commingled with those that are long and strong, can be carried with very little waste through the different operations into yarn.

Such are the leading characteristics of cotton. What are the leading properties of flax? The fibre of flax is the inner bark of the stem of the plant. It was formerly considered, when separated from the wood, a continuous layer, capable of being split into almost infinite fineness. But flax fibres are now known to be cylindrical, and straight, like cotton, and lapped upon each other in filaments about two or three inches in length. The filaments cannot be split. They are united by a glutinous substance that causes them to *cohere* with the greatest tenacity, until it is more or less decomposed. The decomposition of the gluten, to a limited extent, has for ages been effected by *water or dew rotting*, in all flax designed for spinning from "long or cut line." After the rotting the straw is subjected to the operation of breaking, to rid it of the woody portion or shives, and then to the operation of heckling, to liberate the fibres. This is the mode of preparing flax for the flax-mills of Ireland and Great Britain, and also for hand-spinning. But, as the operation of water or dew rotting is attended with much care, labor, and expense, and *endangers the strength* of the fibre, the effect has been to discourage the culture of flax in this country, except for the seed.

These disadvantages have also been felt abroad, and machines were long ago invented and tried for breaking and working flax in the *unrotted* state. The results of repeated trials, both in Ireland and Great Britain, of machines for this purpose not having been satisfactory, the "*cottonizing*" *of flax from unrotted* straw was attempted. Very little success was achieved in cottonizing until the time of Claussen. His modes consisted mainly of cutting the flax into short lengths, and bleaching it, to explode and liberate the fibres. He created a great sensation in the United Kingdom, and in this country, by his supposed discoveries; but it was soon ascertained that the glutinous matter was too imperfectly dissolved under his patents, and that his preliminary process of cutting was too unreliable to secure a sufficient assimilation of the fibres to the fibres of cotton, in *fineness and length, for cotton machinery*. Since then the trade has been constantly experimenting, and it is now well authenticated that the gluten of flax can be effectually dissolved by alkalies and acids, and the fibre evenly liberated lengthwise, and also transversely at the laps. With this knowledge the attention of manufacturers and flax-growers is at present intensely directed to the "getting up" of cheap mechanical contrivances for cutting or breaking flax straw to the requisite length for cottonizing the fibres and throwing off the shives.

From this summary it is apparent that the analogies between the fibres of flax and cotton are striking. While they differ from each other in length, they agree in being cylindrical, fine, and strong; flax having the advantage in strength and perhaps in fineness. Both *cohere* in their natural state; cotton fibres to the seeds, and flax fibres to the stem and to each other. And the cohesion of both is overcome by art—one by the cotton gin, and the other by the shive-breaker and gluten solvent.

The machinery for manufacturing cotton into yarn is arranged for fibres mostly of a length not exceeding seven-eighths of an inch. Any increase beyond this length is objectionable in the spinning operation, as there is only

room between the rolls for an equable draft of fibre of the usual length. Hence it will be desirable, in spinning flax on cotton machinery, to have the *maximum* number of all the fibres correspond in length, as nearly as possible, to the *maximum* number of the fibres of cotton. It will also be desirable to have the fibres evenly liberated by the joint operation of the solvent of the glutinous substance and mechanical force to secure *uniformity in their fineness*, and thereby avoid, what is termed by the trade, "stumpy ends." The want of equality in length of the portion of the flax fibres that are *shorter* than those having the desired *maximum* length, which will not be more injurious than the same want of equality in cotton, renders the assimilation of *flax-cotton* to cotton more *complete;* so that if a *cutting* machine is used for reducing the length of flax straw to the length of cotton, it will not be an objection to the machine that it makes some of the fibres of an uneven length by cutting at or near the laps of the filaments as well as intermediately.

The slightly spiral or bearded surface of the cotton fibre is probably the result of its light specific gravity. All gossamer fibres have more or less tendency to assume this form according to their density. Flax is specifically heavier than cotton. Hence the fibres of the former of the same fineness as the latter would have less disposition to assume a form favorable to a union, which would make it rather more difficult to keep the fibres in contact during the carding, drawing, and spinning operations. But this difficulty could probably be entirely overcome by the capacity of flax to an almost infinite subdivision of fibre. Should machinery be used to *break* or *pull apart* the straw (instead of cutting it) to a length agreeing, as nearly as possible, to the length of cotton, the result would not give a decided uniformity of length to the *maximum* number of fibres, and would, thereby, cause a partial failure of the analogies between the two kinds of fibre. The disagreement, however, might not injuriously affect the carding operation; but it would be necessary to change the condition of the rolls as arranged for drawing and spinning cotton, and arrange them to draw the lengths of the flax fibre that exceeded the maximum length of cotton. This could be accomplished without expense by relieving the intermediate rolls of their weights, which would enable the long fibres to be drawn and spun into yarn of nearly a uniform diameter. Which of these modes for equalizing the length of the fibre will be eventually adopted for flax-cotton is uncertain. Perhaps both will be successfully used. At present the process of cottonizing is too undefined to warrant the prediction of details of a fixed and positive character; but enough has already been discovered to authorize the prediction of an early and satisfactory mode of cottonizing, in a simple and feasible way, under suitable encouragement from government. Such encouragement should, of course, be based upon the expectation that it is not only practicable to cottonize flax, but that its cottonizing can be effected economically, and on a scale commensurate with the wants of the mills. That it may be so cottonized, it is indispensable that the preliminary operations of cutting or breaking the flax straw of suitable lengths, and divesting it of the shives, *should be performed at convenient points in the producing districts*, to save the transportation of the woody portions, precisely as cotton is ginned at the plantations to save the transportation of the seeds. These operations would not only give another analogy between flax and cotton, but would, in connexion with the abandonment of water and dew-rotting, remove the greatest impediment to the extensive culture of the former throughout the country. Flax under such handling would, like cotton, be baled for market in the growing districts. This arrangement, whether connected or not with the decomposition of the glutinous substance, and the fining of the fibres at the producing points, would insure the transportation at a cost as low as that of cotton. It would be desirable to decompose the gluten before transportation,

as this substance constitutes a considerable percentage of the weight of flax. If this was effected, the cost of transportation would be less than that of cotton.

The difference in specific gravity of the two kinds of fibre is said to be equal to twenty per cent. in favor of cotton. This is shown by the different modes of ascertaining the numbers of flax and cotton yarn. A reel for flax yarn is two and a half yards in circumference, and 120 threads make a lea of 300 yards in length. The number of leas to the pound gives the number of the yarn. The fineness of flax yarn necessary for fine shirtings or print cloths is about number 70, equal to 21,000 yards in length to the pound. The reel for cotton yarn is one and a half yards in circumference, and 7 knots of 80 threads each make a skein of 840 yards in length. The number of skeins to the pound gives the number of the yarn. The fineness of cotton yarn necessary for fine shirtings or print cloths is about number 30, equal to 25,200 yards in length to the pound. If the same number of flax or cotton threads to the square inch are put into shirtings or print cloths, then a pound of flax yarn, number 70, will fall short, of the length of a pound of cotton yarn number 30, 4,200 yards, which is equal to twenty per cent. of its number of yards. Hence in the substitution of *flax-cotton* for cotton, there must be added about twenty per cent. to its weight to obtain cloths of the same number of threads to the *square inch* and yarn of the same size. This, although a striking difference in the weight of cloth of the same fineness and the same number of threads, will, fortunately, not so enhance the cost of flax-cotton, as compared with the value of cotton in ordinary times, as to render its substitution impracticable. The loss of weight in flax-cotton by the decomposition of the glutinous substance of the fibres is considered to be about twelve per cent., which is less than the average loss of cotton in waste; so that the diminution of the weight of flax from loss of gluten will be more than balanced by the corresponding loss of cotton in waste.

It remains to show what will be the probable cost of flax-cotton after the adoption of the necessary facilities of production to determine whether or not it can be afforded at rates that will compare favorably with the value of cotton in ordinary times. Much has been said about the proper time for harvesting flax to secure the fibre in the best condition for cottonizing. Some suppose it should be harvested before the maturity of the seeds; others that it may be safely permitted to stand until the seed is in the glaze; and others, again, that it may be harvested when the seed is fully ripe, without injury to the fibre. *Berthollet taught that all fibres of flax are equally fine, whether the straw is harvested early or late.* But while there is a diversity of opinion on the subject of harvesting, it is universally admitted that in order to prevent lateral ramifications from the stems, which would clog the vertical filaments, it is necessary to sow *plenty of seed*—more than has generally been sown in this country; at least two bushels and a peck to the acre. Thick sowing may reduce the quantity of the seed crop, but this will be more than compensated in the improved quality of the fibre. *Cutting* the flax at harvest time will probably be found the best and cheapest mode of securing the crop. This would greatly favor the handling of the straw for liberating the fibres and shives, and be just as well for obtaining the seed. The quantity of flax-cotton that can be obtained from a ton of flax straw properly sown and harvested, and grown upon good soil, is said to be about 400 pounds. This, at ten dollars per ton for the straw, would be two and a half cents per pound for the fibre. To this must be added the twenty per cent. for the additional weight of flax to make cloth of the same number of threads as cotton, equal to half a cent per pound. What it will cost per pound to cut or break it, and free it from the shives and gluten, with machinery properly constructed and chemical processes properly defined, besides baling it for the market, cannot be stated with certainty, but may be

safely estimated not to exceed five cents, thereby giving an entire cost of about eight cents per pound.

From the preceeding analysis it is inferred, first, that flax can be sufficiently assimilated to cotton to be drawn and spun on cotton machinery; and, second, that the assimilation can be accomplished economically, and in quantities commensurate with the wants of all the cotton-mills of the country.

Prominent among those who have labored indefatigably to accomplish the cottonizing of flax in our country is the Rhode Island Society for the Encouragement of Domestic Industry. This society has raised committees, appropriated funds, and collected a vast amount of information. The committee was composed of practical gentlemen, (long identified with the manufacture of cotton and woollen goods,) who gave very thorough attention to their duties. They reported to the society, as the result of their labors, that with proper encouragement the cottonizing of flax could probably be fully realized. A realization so desirable would soon cause such an agricultural, mechanical, and chemical revolution in handling a staple venerable by age and universally endeared to the people, as would soon free the inhabitants of the loyal States from a mortifying dependence on the leading product of the disloyal States, and give to the civilized world endless quantities of this most desirable material for raiment at a cost within the reach of all classes of the community. The society, deeply impressed with the responsibility it had assumed, and with the chances for successful results, memorialized Congress, at its last session, to make an appropriation for aiding in these investigations. It is hoped, now that the price of cotton is so exorbitantly high, and the growers of it are gloating over their monopoly, and that while so much capital invested in our cotton-mills is unproductive, and the cost of supplying raiment to the people so enormous, that Congress will meet the wants of the times by an appropriation sufficiently liberal to insure the happy consummation of this great national enterprise.

FARM IMPLEMENTS AND MACHINERY.

BY J. J. THOMAS, UNION SPRINGS, N. Y.

The two great requisites for successful cultivation are a fertile soil, and the means for its working and pulverization. The first is attained by natural excellence combined with manuring, rotation, and ploughing in green crops. The second is accomplished by farm implements and machinery. Without the latter, no soil, however excellent, can be cultivated. They are as indispensable as the breathing apparatus to the life of an animal, or as vessels to the navigation of the seas. In nothing is the advancement of modern agriculture more conspicuous than in the rapid improvement of the tools and machinery of the farm.

Compare, for example, the old wooden mould-board plough, extensively used not fifty years ago, with the best modern "centre-draught," or steel mould-board, easy running, smooth cutting, and inverting the sod almost with mathematical precision; or the old-fashioned mode of pounding out grain with the flail, with the best improved threshers and separators. Observe the difference in expense between laboriously collecting the hay of a ten-acre meadow by

means of hand-rakes and sweeping it up with horse-power, with revolving or steel tooth-rakes, or the slow and fatiguing labor of dropping the minute seeds of root crops, when compared with the rapid and accurate distribution by the best seed drills. No laborer who has gone through the slow toil of swinging the hand-scythe and cradle day after day will need any argument to prove to him the value of horse labor as applied to the best mowing and reaping machines, which shear off ten or twenty acre crops in a day. And during the present scarcity of labor, occasioned by the war, extensive farmers must have utterly failed to go through with their many operations but for the assistance rendered by modern implements for cultivating, drill-planting, harvesting, and threshing.

The amount of capital at present invested in farm implements throughout the United States is probably not less than five hundred million dollars! How important that this money be *well* invested! The best implements will execute work not only better and more perfectly, but at a vast saving in expense, over those of bad construction. Take one of the simplest tools as an example: the common hand-hoe, one made of best steel, and of light, neat construction, will enable a laborer to do one-fourth more work than a heavy, clumsy one, or will save, one day in four, twenty-five days in every hundred of work—an amount, in a single season, more than fifty times as great as the difference in cost. The best steel plough may cost five dollars more than a poor cast-iron one; but the force required to draw it, if one-fourth less, would save the labor in a span of horses, of one day in every four, and perhaps fifty or a hundred dollars yearly. What would be thought of the man who, to avoid the expense of buying a good plough, preferred to spade up his fields by hand, or to carry his grain to market on his back, to obviate the cost of a farm wagon? He would commit the same kind of error, although perhaps more glaringly, as the farmer who neglects to avail himself of the best information on the machinery of the farm and the principles of its construction and use. Much loss has been occasioned by a want of knowledge of the principles which govern the working of all implements and machines, and many suffer themselves to be imposed on and deceived, when a simple and ready application of such principles would at once detect errors without resorting to expensive trial. The day is past for the commission of such blunders as the man who thought he was favoring the weaker horse in his team by giving it the small or short end of the whiffletree, or of the other man who balanced the bushel of grain, when carried to the mill on his horse's back, by placing the grain in one end of the bag and a large stone in the other. But still no one can visit any large agricultural fair without witnessing, among the large collection of farm implements, instances of glaring departure from fundamental mechanical principles. There are two great laws that should be thoroughly mastered by every farmer as well as every manufacturer—by the former, that he may the better select and make his purchases; and by the latter, that all his work may be as perfect in construction as possible. These are the law of virtual velocities and the law of momentum. 1st. The former, familiar to many readers of this article, may be briefly explained to others before citing cases of its application. This law—simply expressed by "whatever is gained in power is lost in time," (or distance,) or by the formula that forces are always equal when the products of the power, multiplied by the distance, are equal—renders easily understood the principle of the working of every mechanical power or machine, from the simplest lever to the most complex combination of cranks and wheels. It explains equally well the capacity and power of the crowbar or of the steam-engine. In the use of the crowbar, or any other lever, it explains how the strength of a hundred pounds applied by the hand to one part will raise a thousand pounds weight resting on another part—the hand or power being required in such a case to move ten times the distance of the

weight. To lift the weight one inch the hand moves ten inches. The two forces, multiplied by their respective moving distances, namely, 100 by 10 inches and 1,000 by 1 inch, give equal products. This principle at once renders plain and intelligible the amount of efficiency in all the mechanical powers, as the lever, wheel, inclined plane, wedge, or screw. Throwing friction aside, it gives the exact relative force of the moving power and of the operative power with mathematical precision. Explained by this law the famous "hydrostatic paradox" ceases to be paradoxical, but the inevitable result of unchangeable laws. The application of this law to machinery, for example, to a threshing machine, gives the force with which the teeth of the cylinder strike the straw, and consequently the amount of resistance which will stop it. If four horses drive such a machine, walking at the rate of three feet in a second, the cylinder, revolving at a velocity of ninety feet in a second, has a force thirty times less, or seven and a half times less than the force exerted by a single horse. This calculation shows the facility with which small obstructions, as, for example, an over feeding, will stop such machines. On the other hand, horses applied to slow working parts, as in a stump-puller, where the stump is moved, perhaps, one hundred times slower than the working force, possess immense power. If, for instance, the horses travel thirty times faster than the movement by which the stump is raised, the force, instead of being diminished, as in the last example, is increased thirty fold, or equal to the power of 120 horses, friction deducted. If each horse draws with a force of 300 pounds, the power would be equal to raising a weight of thirty-six thousand pounds. In the same way the wonderful force of the hydrostatic press—which is such that a man might, with one not larger than a water pail standing on a table before him, cut through a thick bar of solid iron with as much ease as he would chip pasteboard with a pair of shears—may be determined with equal accuracy. The operation of all mechanical contrivances may be explained and rendered simple by the application of the law of virtual velocities. It explains the steelyard, the platform balance, the toggle-joint, the rolling-mill, the cylindrical straw-cutter, the wedge power of the plough, the construction of the compound whiffletree, the power of the cider-press, the force of pulleys, the required strength of the mole-plough, &c. In all these machines, the application of this law to every part is of the utmost importance in construction, that every part may be of just the required proportionate strength. Where great pressure occurs, these slow-moving parts must be correspondingly strong. Where there is less pressure, and greater velocity exists, lightness and less strength is essential. Thus a scientific mechanic may be able to manufacture machines equally strong with those made by his ignorant competitor, with less waste of material and less probability of breaking in weak places, and to become beaten to pieces by the momentum of its needlessly heavy parts.

Even in the construction of so simple a thing as a farm-gate, a great deal of skill may be shown by making the slow-moving parts, which are near the hinges, strong and comparatively massive, while the latch end should be rendered as light as practicable. We sometimes see gates made needlessly heavy at the latch end, drawing the hinges, and settling or becoming beaten to pieces against the post; while others, better made, equally strong, and half the weight, keep their position, move easily, work satisfactorily, and remain strong and uninjured. A farm-wagon, which has to be drawn thousands of miles yearly, should, in order to be as light as possible, have the strength of each part accurately adjusted to its intended use; and, although no one expects to see so perfect a vehicle as Dr. Holmes's famous "one-horse shay," it is well to endeavor to carry out the leading principle as nearly as may be practicable.

2d. The powerful effects of momentum deserve a few passing remarks, as affecting the operation of implements and machines. Its great effective force is exhibited by such simple operations as driving nails with a hammer, or wedges

with a maul or beetle. The mere weight of the hammer, with the strength of the arm added, would produce no effect; the momentum does the work in a moment. The momentum of a rifle-ball in motion, small as it is, carries it through solid plank. On a large scale the power of the pile-engine depends on this principle. The water-ram owes its acting to the momentum of the water in the driving-pipe. The fly-wheel in the same way equalizes the irregular or interrupted resistance, or jerking of various machines, such as straw-cutters, horse-pumps, and churns. These are the beneficial results of momentum. Sometimes it produces disaster, as when a heavy-loaded wagon strikes a stone, the sudden effect of which is lessened on wagon, harness, and horses by the use of springs under the load. It was ascertained, by experiments made many years ago, that the machinery of a railway locomotive, when supported by springs, would endure the wear and tear of use four times as long as without them.

Inventors of machinery are sometimes much puzzled at the failure of a full-sized machine, when the small model had previously worked without any fault. The enormous increase of momentum, caused by enlarging every part, they did not take into the account. If, for example, a model, six inches long, be increased to a machine five feet long, every part must be increased ten times in length and diameter, a hundred times in square or cross section, and a thousand times in weight or cubic measure, the momentum of every moving part would, consequently, be increased ten thousand times; that is, the increased weight, one thousand, multiplied by the increased moving distance, or ten times. While, therefore, its strength or cross section is augmented a hundred times, the tendency to become broken, or battered to pieces by its own working, would be a hundred times greater. For this reason a model should be used only to show its construction, and never to test the performance. Every farmer would be much benefited by a knowledge of all the leading principles of mechanics, and a practical readiness in applying them in the innumerable occasions that are constantly occurring. This study has a great advantage over that of chemistry, as applied to agriculture, in that it is precise, certain, and reliable; while the principles of chemistry must be applied with constant variation and allowance for the numberless controlling causes of drought, moisture, change of season, imperfections of analysis, &c., which frequently render it of little use, and sometimes an indirect source of serious error.

IMPLEMENTS FOR TILLAGE.

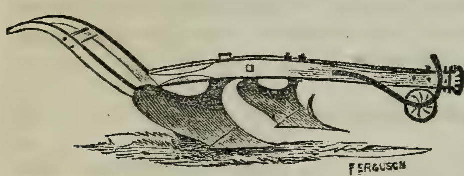
These are chiefly the plough, harrow, cultivator, roller, and seed-drill, in their various modifications. It is not intended to give here a description of the different kinds, but to point out some of the advantages which they respectively possess, the defects to which they are liable, and the application of mechanical principles in their construction and use.

THE PLOUGH.

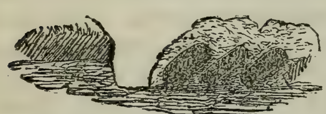
This implement, which may be regarded as the chief means for successful tillage, is of such importance that it has from time immemorial become the symbol of the agricultural profession. Notwithstanding the many recent contrivances of rotary diggers, grubbers, terracultors, &c., it is not probable that the plough will be very soon superseded. Its great leading feature is simplicity; it consists substantially of a single part, or is one solid moving whole, although in its manufacture several parts are united together. This simplicity or oneness is of the utmost importance in an implement doing such work, subjected as it is to heavy force, and especially to irregular resistance and frequent heavy blows from stones and other obstructions. No complex implement can endure a constant repetition of such blows. Even the railway locomotive, with its great strength, would be soon beaten to pieces if removed from its rails of

glassy smoothness, and subjected to repeated blows by obstructions in its way. This is one reason why Pratt's Ditcher, weighing nearly half a ton, and consisting of many parts, resulted in failure, although promising well when new, and with none of its parts distorted and bent. All the complex substitutes for the plough, invented of late years, will doubtless result in failure for the same reason, however ingenious and perfect in other respects.

Since the wooden ploughs were used in the early part of the present century, down to the present time, this implement has become wonderfully improved. For perfect, smooth, even inversion of sod, and for deep, thorough, and complete pulverization, combined with ease of draught, it would seem that the best ploughs have very nearly attained perfection, so far as they can with the present form. Different modifications are provided for different purposes and soils. For sod ploughing, and in light or sandy soils, a long mould-board for smoothly turning the sward is found best. Where the soil is more tenacious, and the friction or adhesion to the mould-board greater, a shorter one is more advantageous both for easy draught and for pulverizing the newly-turned earth. For stony ground a short mould-board is absolutely necessary. For deep tillage the form should be such as to lift the earth upward to a greater height than for more shallow work. A variation is made in the cutting part, for lapping the furrows in heavy land for exposure to frost, and effecting drainage on the one hand, and for laying the furrows flat on light soils on the other. For turning in the top soil or sod deeply, and covering it well with the mellowed earth from the bottom of the furrow, nothing has proved equal to the double Michigan plough; and this, no doubt, would be the best implement for turning under such spreading and perennial-rooted weeds as the Canada thistle, which, if repeatedly and well done, will totally destroy any patch in a single season, if the soil have some tenacity. The Universal Plough, invented by Gov. Holbrook, of Vermont, and manufactured by Nourse, Mason & Co., of Boston, is a valuable invention. It admits of a ready replacing of one mould-board by any other, according to the intended purpose or variation of soil, several mould-boards belonging to each plough. Many theories have been advanced as to the best form of the mould-board, and a volume might be occupied with the consideration of the subject. It may be sufficient here to remark, that no mould-board should be accepted by a farmer which does not wear nearly equally in every part, both on account of its durability and of the ease with which the moving earth may slide over its surface. One is also objectionable which becomes clogged in some particular part, while other parts are scoured by the sod. The ease of draught may be estimated with some accuracy by a close-observing farmer who watches the exertions of his teams; but a good dynamometer (one form of which is a stiff spring-balance strong enough for measuring six or eight hundred pounds) is the only reliable and satisfactory measure of the ease of draught.



Sod inverted by common plough.



Sod inverted by Michigan plough.

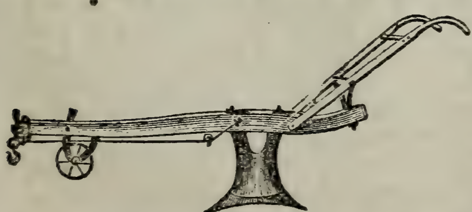
SUBSOIL PLOUGHS.

A considerable diversity of opinion prevails as to the value of these ploughs. As it usually happens in such cases of diversity, all are more or less in the right. Farming, as much as any occupation, requires a constant exercise of the judgment, or a combination of sound reasoning powers with experience

and observation. The farmer must vary his practice with circumstances. 1st. A soil already deep and loose does not need subsoiling. A gravelly bottom to the furrows would be little better after the passage of this implement. 2d. A sterile subsoil supporting a rich top soil would only serve, when loosened, as a regulator of moisture, receiving water like a sponge during the time of heavy rains, and retaining it for periods of drought. It would not, of course, add to the fertility of the bed in which the roots of the crop extend themselves. 3d. A heavy and undrained soil would be benefited only temporarily. The first heavy soaking it received would settle the whole mass back again nearly to its original degree of compactness. 4th. But for any hard subsoil, whether sterile or not, if naturally or artificially underdrained, subsoiling can scarcely ever fail to be substantially useful, and its benefits last some years without a repetition of the process. If the subsoil is sterile, as already mentioned, it becomes a reservoir or sponge, and tends to prevent both drowning out and drought; and the gradual deepening process, which the best farmers desire, may be effected through its assistance by permitting the common or trench plough to run a little deeper into the mellowed bed each successive year. There is nothing which will enable that form of the trench plough, known as the Double Michigan, to do its work in the most satisfactory manner better than a previous loosening by the subsoiler, whether it be done one, two, or three years previously. Where both surface and under soil are naturally fertile, its advantages are rendered eminently conspicuous, and in such a case the trench plough may be used to its full depth without fear, the mixing of the two portions proving usually of great advantage. Soils so treated have frequently contributed to a greatly increased growth of wheat, and invariably to larger crops of carrots and beets. The observing farmer will readily determine which of these different circumstances are his own, and act accordingly.

FORM OF THE SUBSOIL PLOUGH.

The object being merely to loosen up the under soil, a slight elevation of its substance by means of the passage of a horizontal acute wedge a few inches below the bottom of a common ploughed furrow is all that is necessary. The shank connecting this horizontal wedge with the plough-beam should be thin, that it may pass easily forward through the subsoil. A form similar to that represented in the annexed cut has been extensively used. The shank is reversed when the forward point becomes worn, and the rear one brought forward in its place, thus giving it double durability. This form of the plough answers well when the subsoil is quite dry, free from stones, or moderately light in texture, or free from much clay. But the shoe is too long to run well among stones; and if the soil is tenacious and rather wet, it presses against the flat faces of the shank, and produces an enormous amount of friction, almost incredible to one who has not tried the experiment. A narrow shank, properly braced to give it strength, and a short shoe, are therefore best for either stony or clayey soils. The ditching plough, mentioned on a subsequent page, very nearly meets both these requirements, and may be made to answer a good purpose for subsoiling such land.



STEAM PLOUGHS.

The difficulties in the way of the introduction of these are formidable, and, for the circumstances of the farmers of this country, it is feared they will not be soon overcome, unless on level land free from stone. 1. If the engine is

used as a locomotive for drawing the plough or the gang, its weight is necessarily such as to sink it into any good soft soil, unless the wheels are made very broad and of great diameter, which adds to the already formidable weight. The engine and its gang become quite a complex machine, and the uneven surface and occasional obstructions tend to injure and derange the parts. The friction caused by the soft and yielding surface of the ground is another formidable difficulty. Careful experiments, made with the dynamometer, have established the fact that it requires eleven times the force to draw a heavy load over a common hard road as on a smooth railroad; and on a new unpacked gravel road the disparity is as thirty-five to one. Taking the new gravel road as a standard representing the soil of a field, (although the latter is often much the softer,) the loss occasioned by this resistance to the engine would be thirty-five times as great as the same loss on iron rails.

2. The only practical success which has attended steam ploughing has been by the use of fixed engines, working the plough by means of wire cables. In England, where iron machinery, coal, and labor are cheap, it has been performed at an actual expense of two dollars per acre. In this country it would, probably, cost at least three dollars, and require a heavy expenditure of capital in machinery and engineer's wages. Ploughing by horse labor, as now performed in this country, is much cheaper. In addition to these difficulties, as it involves the constant use of a great deal of machinery consisting of many parts, unless all these parts are perfect, some will be strained at obstructions, and, perhaps, become deranged or broken. Where there are so many parts there are frequent chances for one or more to get out of order, and when this is the case, the whole must come to a stand still, including engineer, superintendent, and all hands, until a repair is effected. While every effort should be encouraged to attain so desirable an end as a good steam plough, it only serves ultimately to repress enterprise, to hold out false hopes that may lead to loss and disappointment. All difficulties may be most easily overcome by fully understanding at the outset their whole character and strength.

DITCHING PLOUGHS.

Since tile-draining has become so essential and advantageous to good farming, many attempts have been made to dig ditches by a more easy and rapid mode than by the laborious operation of the hands. The various ditching machines have proved of little or no value, after a full trial, however flattering their operations may have appeared at first. Complexity in nearly every instance has been the great leading difficulty. The ditching plough, an implement merely for loosening the subsoil and obviating the use of the pick, has proved successful; but still the loosened earth must be shovelled out by hand. Where the subsoil is hard, the amount of time required to loosen it with the pick is often two-thirds or three-fourths of the entire labor. When this is done by horse-power, a great saving is consequently effected. Its essential characteristic consists in admitting so great a change in the height of the beam and handles, that it may be run down in the bottom of the ditch to a depth of four feet. The movable portion of the beam is attached to a fixed beam by a stout loop and staple, and rises on the cast-iron arc which passes through it. The handles rise on a stiff wooden arc, a piece of thick plank being placed between the handles and fastened to them to render them more firm and steady. The iron-work, although light, is braced so as to impart great strength and security. The point is screwed on separately, and is the only part that wears much by use. This implement is drawn by two horses, attached to the opposite ends of a long main whiffletree, about eight feet long, so that each animal may walk firmly and securely on each side of the ditch. If the point is sharp, (made of the best chilled cast-iron or steel,) two

or three times passing along the bottom of the ditch will loosen a compact hardpan, to a depth of five or six inches. This loosened earth is then easily thrown out by hand. The best tools for this purpose are the common long-handled, round-pointed shovels, bent up at the sides at the blacksmith's shop. One span of horses will loosen subsoil fast enough to keep eight or ten men constantly shovelling out, and they will cut about one hundred rods of three-feet ditch in a day; or an hour or two of ploughing each morning in a sufficient length of ditch will keep two men occupied in shovelling the rest of the day. The writer of these remarks has thus cut many miles of tile-drain, usually at a cost of about one-half the sum charged by ditchers by hand. In several instances where the usual price for hand-ditching was thirty cents per rod, the whole expense, with the assistance of the plough, has not been over twelve cents per rod. On a tenant-farm some miles distant, where the work could not be personally superintended, the saving was much less. In soil where the pick is not needed, this plough would, evidently, be of no value.

PLOUGHING WITH THREE HORSES.

The principles of draught clearly point out that which farmers have long since observed in practice, that a horse will exert much more force when placed near the plough, sled, or vehicle to be drawn, than can be used when a long draught-chain places the team more remote. An experienced stage proprietor has given it as his opinion that three horses placed abreast will draw his vehicle as well as four with two leaders in advance in the usual way. My own experiments in ploughing have led me nearly to the same conclusion. The mode of constructing the whiffletrees for this purpose is familiar to most farmers; but as the right-hand horse walking in the furrow necessarily places the other two so far to the left as to create a new centre of draught, a special contrivance is necessary to enable a common plough to run as with two horses. A good way, adopted by some plough manufacturers, is to place an iron arc between the handles, to which the rear end of the beam is screwed, and along which arc it is capable of being moved, until the right centre of draught is attained. Another way is to construct a clevis bent several inches to the left side of the beam.

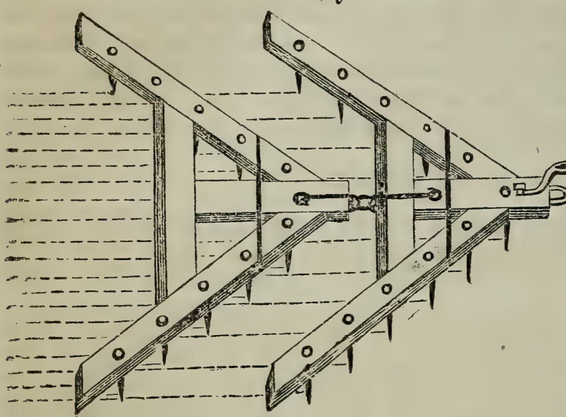
Three horses are driven by the ploughman with the same facility as a two-horse team, and do not require an additional driver, as becomes necessary with four. As a deeper cultivation would improve the character of farming, in all places where the character of the soil properly admits it, there is no doubt that the general adoption of the three-horse system would become a considerable agent in improved agriculture.

HARROWS.

The importance of fine pulverization of soil is not sufficiently appreciated. Where the fine, delicate, threadlike fibres of the roots of any crop have to make their way through a hard and dry mass of baked earth, or at best among coarse broken clods, they must grow and receive nourishment at an immense disadvantage when compared with the extension of the same roots through a finely pulverized, soft, and moist bed of earth, permitting and favoring their free ramification in all directions. Every good implement, therefore, for effecting such pulverization becomes a most important assistant to the successful agriculturist. The fine and thorough intermixture of manure with soils, at the time of their application, especially if in the spring, contributes almost incredibly to their efficiency; and in accomplishing this desirable end a free use of the harrow in breaking it fine and working it by repeated passings into the mellow soil, should never be omitted before the plough turns it under. Harrows should be modified in their construction according to the nature of the

soil. Where it is free from stones and other obstructions the teeth should be small and numerous—say about fifty teeth, three-fourths of an inch square, to each harrow. These will pulverize the soil more perfectly than a few coarse teeth, and leave a fine level surface. Where there are roots, stones, and other obstructions, the teeth are to be fewer and larger, thirty being a common number. The teeth will pass through the earth more freely and be more efficient if the corner or angles, and not the flat sides, are placed foremost. For very hard soils efficient harrows are made by using flat, sharp-edged steel teeth.

Where obstructions of any kind exist at the surface, the double triangular harrow is easiest for the team. It is like two V's placed with their points forward, one within the other. They press obstructions aside like the sharp prow of a vessel. This harrow is hinged at the middle, to fit uneven ground. There are two modes of placing the hinges. In one, termed the Geddes harrow, the joint on which the hinges are placed is in the same direction as the line of draught, and the two sides fold like the leaves of a book. In this case the team must not be attached to the forward point, or the centre will be lifted from the ground in use. But a chain is fastened a short distance backward on each side for this purpose. The Hanford harrow differs from this in having the two V's made each in a solid piece, and placing a single hinge between them, which thus operates crosswise, instead of lengthwise, with the draught. In crossing a ridge or depression this harrow adapts itself readily to the surface; or if an obstruction should raise the forward frame, the rear one is not raised with it, as in the Geddes harrow. A common clevis, placed on this harrow, will lift the forward end. It should have one especially for this purpose, bent up two or three inches.



For pulverizing the upper surface of inverted green sward nothing is equal to Shear's harrow, or others constructed on a similar principle. The teeth being sharp, flat blades, cut with great efficiency, and as they slope backward like a sled-runner, they pass over and press down the sod at the same time that they slice off its upper face and reduce it to fine powder. A single passing will give a mellow surface more than twice as deep as the common harrow, operating at the same time as a roller to keep the grassy part down in its place. As usually constructed the teeth have been made of cast-iron, which causes them to be heavy, easily broken, and soon worn dull. If made of steel, they would be incomparably better, and the harrow would prove invaluable to every farmer who plants a crop on inverted sod.

DRILLING AND SOWING MACHINES.

The rapidity and precision with which small seeds are distributed and covered by the use of seed-drills renders them absolutely necessary to the successful raising of such crops as carrots, turnips, beets, &c., in fields. The prescribed limits of this short article preclude even a notice of the different good machines now in market and use. The general principles on which they operate, the regular and measured distribution of the seeds, by means of revolving cylinders furnished with small cavities, or by the vibratory motion of perforated plates and

the passage of the seed down into the mellow earth through a hollow coulter, where it is immediately buried by the earth falling back upon it as soon as the coulter has passed—these principles of construction are adopted in all, and are familiar to all who use them. But there is one requisite for success that has been too much overlooked—the proper adjustment of depth for the seed. If too shallow, the seeds will not vegetate; if too deep, they will be smothered. Except, however, in times of considerable drought, the depth is usually too great. I have known beet seeds to fail entirely when planted three inches deep, and the seedsman denounced for selling bad seeds; but afterwards, when planted from the same package only an inch in depth, they grew profusely. The failure from drought rarely occurs to such seeds if planted early enough in the season. Some variation must be made with the nature of the soil. Seeds may be placed deeper in a light gravelly soil than in a strong, heavy one. No better investment of a few days' time and labor could be made by any farmer than in a few experiments under varying circumstances to determine the best depth for setting his seed-drills. There is no question that much of the objection that has been made to the use of the wheat-drill has arisen from too deep planting. The writer of these remarks made a few experiments the present year on a light loam to determine this question, the planting being done in the spring of the year, when the soil was more moist than it frequently is at the time of sowing winter wheat.

Wheat planted half an inch deep came up in five days, and an inch deep in six days. Six weeks afterwards there was no perceptible difference in the appearance of the plants. That planted two inches deep came up in seven days, and at six weeks did not appear quite so good. The time for coming up continued to lengthen, and the quality of the crop to decrease, until, at a depth of six inches, very few slender stalks appeared. It is easy to understand from this experiment that a farmer may fail in his drilled crop with the seeds buried too deep, when more shallow but imperfect covering of the harrow would result in success. It is obvious, however, that a drilling-machine properly set would be the best, as all would be buried at a certain depth, and not in the irregular manner performed by the harrow. Hence it has been found that a difference of five bushels per acre in the crop in favor of drilled field, when the work was properly done, has not been unusual. It should not be overlooked that a dry, coarsely pulverized soil may afford air to the buried seeds at a depth twice as great as a fine, compact soil, and the farmer must, therefore, exercise some discretion and judgment, in which the occasional performance of experiments would greatly assist him.

Experiments performed at the same time with corn, oats, and beans, gave similar results. Nearly all the grains of corn grew, to a depth of six inches, and those varying from half an inch to two inches in depth presented no material difference five weeks afterwards; but the others were feebler as the depth increased. The results with oats were about the same as with corn, all beyond two inches in depth being of feebler growth. In beans, the effect of deep burying was more fatal. Those plants one-half, three-fourths, and one inch deep did not materially vary. At two inches depth there was a marked difference; few came up at three inches; very few at four; and none at all at greater depths.

CULTIVATORS.

The importance of a constant use of cultivators during the growth of drilled crops is not sufficiently appreciated. The remark has been made, and no doubt justly, that one day's work with a horse and cultivator in a corn-field is worth ten with a common hand-hoe. One of the finest corn crops I ever saw was grown on land of moderate fertility, dressed *once a week* with the horse cultivator from the time it made its first appearance above ground till the

projecting ears from the rows obstructed its further passage. In an experiment on heavy or clayey soil, one portion of the field was cultivated in the usual way, that is, the surface was but imperfectly broken aud much of it left hard and cloddy; the other portion was made as mellow as an ash-heap, and the result was, it produced just double the crop obtained from the other part.

In order that the cultivator may pass as near to the rows as possible, it is important that the rows be both even and straight. Hence one great advantage of the accuracy and precision of seed-drills in planting. An implement recently invented by S. W. Hall, of Elmira, New York, although not yet sufficiently perfected for general introduction, forms straight, even, and perfectly parallel rows, on a principle similar to that of the carpenter's gauge; the horses being kept in their places accurately by one of them walking in a furrow previously made by the machine; and is thus used, both in planting and in cultivating the crops. The little hand-hoeing thus needed is rendered still less by two guards in the form of vertical knives, which at the same moment cut close to the rows and protect the plants when small from being covered by the freshly thrown up earth from the cultivator-teeth. A present defect in nearly all American "cultivators" is the want of rapid execution. The valuable time of a man is required to manage a one-horse implement, taking a single row at a time, and often being required to pass two or three times before each row is finished. Two horses should be used, and two or more rows cultivated at each passing, which could only be effected by straight and even rows, planted by machinery. Garretts's horse-hoe, an English invention for dressing carrots and other drilled root crops, is a fine exemplification of this object. It is furnished with sharp, horizontal blades, which run beneath the surface and shave off and destroy all the weeds within an inch of the rows of young plants. These rows, having been accurately drilled, are straight and perfectly parallel, and the operator has only to watch a single row and guide his blades to that row by means of a lever which operates altogether. Aldens's thill cultivator may perhaps be modified in future so as to accomplish this object, at least in part. The thills, under its motion, are more steady than that of the common cultivator, and the handles enable the operator to press it to the right or left, so that he may cut as closely tothe rows as he desires. Formerly the teeth of cultivators were mostly made of cast-iron; now all the best ones are of steel plate. The steel are lighter, keep clean better, keep sharp, and last longer.

Clod-crushers, whether made in the cheap form known as the "drag-log," or drag-roller, or in the more perfect mode of revolving cast-iron toothed discs, like cross-hills, are occasionally of much benefit in reducing the hard clods of clay soils. Where the early part of the season has been unusually wet, followed by drought, such clods will be abundant. After they have been ground down and pulverized by this implement, the earth which has been thus compactly pressed together must be loosened up again by means of a two-horse cultivator or a scarifier. Failure in the use of clod-crushers has generally resulted in using them when the soil is too moist, and by neglecting to loosen the soil as just described. The introduction of the regular system of tile-draining, which tends to prevent soils from becoming cloddy, will greatly lessen the necessity for the use of this implement.

MOWING AND REAPING MACHINES.

No improvement in modern husbandry has been more marked and rapid than that effected by the invention and introduction of mowers and reapers. They have placed the farmer above the contingency of finding many extra hands for

securing his crops at a critical juncture, and on this account can extend his breadth of sowing with the confidence of being able to secure what he raises. To be thrown back on the sickle and hand-cradle would as much derange the business of farming, as that of the travelling public to be deprived of railways, and to be driven back to stage-coaches. The past ten years have witnessed great improvements in these machines themselves. They are made stronger, lighter, more durable, more efficient, and of easier draught; and what is not least in importance, the best ones cut as perfectly when moving at the rate of one mile per hour as three or four miles, which was formerly necessary. Teams had then to be driven with severity, and soon became exhausted; now even the slow pace of oxen does good work. There is now a large number of patents, and many good machines are made of different forms. It is as important that the machines be well manufactured as well invented. To be both light and effective, the very best materials must be used and every part made in the best working order, and it is safest for farmers to purchase of those whose machines have become established in character by two or three seasons' use. The amount of work which a good machine will perform is easily and accurately estimated. If the strip of grass or grain cut at each passing is four feet and two inches, (or one-fourth of a rod,) a pace of two miles an hour as an average, including stoppings, would accomplish an acre per hour, or eight acres in a working day of eight hours. This has frequently been greatly exceeded by the use of an efficient team. At this time in the season farm horses usually have but little to do, and in making a fair estimate of their labor it may be, therefore, placed rather low. In estimating a mowing-machine, which needs only a driver, it would be sufficiently liberal to call the work of a man and team two dollars a day. Estimating the average day's work at eight acres a day, and the product of the meadow at two tons, the cost of cutting would be twelve and a half cents per ton, besides the use of the machine.

It has been found that the best mowers, as made some years ago, would cut about one thousand acres before wearing out, and need but little repairs during that time, or at a rate of about twelve cents per acre, all things estimated. The better machines now manufactured would probably do much more, on account of their easier and smoother running, occasioning less rattle and wear. It would, perhaps, be safe to say ten cents per acre or five cents per ton, under good management, as the cost of the machines in actual use. This added to the preceding estimate on the man and team, would make seventeen and a half cents per ton, as cost of cutting. Since writing this estimate, I have examined the figures of a neighbor who is an extensive farmer, cutting some two hundred acres annually. His results are very near my figures, or sixteen cents a ton, where the grass yields two tons per acre. As no spreading is needed, the next operation is the raking. With the best revolver or spring-tooth rake, a width of ten feet may be taken at a time, say eight and a fourth to be within bounds, or one-half a rod. A horse travelling two miles an hour, including all stoppages, (all good horses would much exceed this,) would rake two acres an hour, and sixteen in a day of eight hours, at a cost of a dollar and a half, or at less than nine and a half cents an acre, or about four cents a ton. This added to the seventeen and a half cents for cutting, would give the hay in the winrow at less than twenty-two cents per ton. The figures here given may be altered to suit the different circumstances of various localities, difference in wages, &c. There are also several drawbacks which farmers who are not energetic and efficient managers may materially experience. A poor machine may be procured or a good one allowed to get out of order. A poor team or a bad driver may be employed. The meadows may be rougher than the best farmers would ever tolerate, or covered with stones, or not rolled each spring, as every meadow should be, until its smoothness is unquestioned. The grass may be light or only one ton per acre, thus doubling all the estimates by this deficiency alone.

With those who cut but few acres per year, the interest on the idle machine would still further reduce the profits.

With all these adverse circumstances, it is not unusual to find an actual cost three or four times as great as the standard here given; and for this reason some intelligent men have been led to pronounce as gross exaggeration all statements not within their own experience or observation. The accidents and disasters of weather scarcely affect the preceding result as applied to the hay in the winrow, although heavy rains before raking might injure the quality. The cost of drawing in is not given, as it varies with local circumstances, distance to draw, mode of securing, whether by hand or horse fork, &c. For the sake of contrast, I give an estimate of making hay till it reaches the winrow, as practiced under the old mode of cutting with the scythe, tedding from the swarth, and raking by hand:

To mowing one acre by hand, (double this cost if lodged,) one acre of two tons, average	$1 00
To spreading by hand	15
To raking by hand	50
	1 65

or at least eighty-two cents per ton to the winrow, instead of twenty-two, as with the best machine management.

But there is one prominent item of disparity not yet attended to. The rapidity with which the grass may be cut and secured enables the farmer to select good weather for the work, and to wait till a lowering sky disappears. He rarely, therefore, meets with those adverse occurrences, rain-showers, that so much increase the labor and diminish the value of the crops. But when hand labor was exclusively employed, it was often necessary to keep moving on without delay for several weeks, or the large meadows could not be cleared, and there were, consequently, all the chances for meeting with showers. On some large farms, a mowing-machine has paid for itself in a single year, by avoiding such disasters.

Reaping-machines, requiring usually an additional hand for raking and several men to bind, are not as great savers of labor; but they become indirectly the means of preventing much loss, whenever there is danger of such loss by a delay in harvesting beyond the best time, or by continued storms. Many efforts have been made to contrive a successful binding-machine. When this is accomplished, their efficiency will be much increased. The limits of this article prevent a further extension of these remarks on mowers and reapers, or on the last and important farm process with grain crops, namely, threshing and winnowing. The great perfection of threshing and winnowing, and the improvement effected in the smaller threshers, as driven by the endless-chain power, can hardly be too highly appreciated by intelligent farmers of moderate business. Before closing it may be well to give a list of the principal implements and machines needed to furnish a hundred and fifty acre farm devoted to mixed husbandry, and their approximate cost:

3 ploughs fitted for work, (steel ploughs are best)	$34 00
1 subsoil plough; 1 double Michigan plough	24 00
1 one-horse plough; 2 cultivators	22 00
1 harrow, $12; 1 roller, $10	22 00
1 corn-planter; 1 seed-drill	15 00
1 wheat-drill, $65; 1 fanning-mill, $25	90 00
1 root-slicer; 1 straw-cutter	20 00
1 horse-rake; 2 hand-rakes	10 00
2 farm wagons; 1 one-horse cart	190 00
Hay rack; harness, &c., for cart	38 00
1 sled and fixtures, $30; 1 combined mower and reaper, $125	155 00

2 scythes; 1 grain-cradle	7 00
1 shovel; 1 scoop-shovel; 2 spades	5 00
2 manure-forks; 4 hay-forks	6 00
1 horse-fork for hay, \$10; 1 pointed shovel, \$1	11 00
1 pick; 1 crowbar	3 00
2 ladders; 2 sheep-shears	5 00
Large and small steelyards, \$3; half-bushel measure, \$1	4 00
1 maul and wedges; 1 axe; 1 wood-saw	4 00
1 wheelbarrow; 1 grindstone	8 00
Hand-hoes, baskets, stable lantern, currycomb, hammer, &c	5 00
1 endless-chain horse-power threshing-machine and separator	160 00
1 circular saw	30 00
Platform scales for weighing cattle, hay, &c	100 00
	968 00

As the farm wagons have to be drawn many thousand miles each year in the aggregate, they should be made light and strong, for a needless pound drawn ten thousand miles is one pound too much. The improved iron axles are best. The horse-power may be used for threshing, cutting straw and stalks, sawing wood and slitting pickets, turning grindstone, driving churn, and other operations, if properly placed, with a supply of rods and bands. The platform scales will soon reimburse the cost, in the information it will give the proprietor on the best mode of feeding and fattening animals, in connexion with experiments for this purpose, independent of its utility in weighing cattle and hay when sold from the farm. No careful farmer will forget the importance of keeping all his wooden implements that are liable to exposure to the weather well covered with paint; and those which may receive much of the sun's rays should be painted a light color, as white, yellow, or light brown. Dark colors absorb the heat of the sun, become much hotter than light colors, and cause twisting, warping, and cracking by exposure. And lastly, every provident husbandman who desires to have his tools always in good order and always at hand, where he can lay his hand on any one in a moment, without the annoyance and loss of long searches when work is pressing and men waiting, will have a neat tool-house, arranged on a plan similar to that described in the Patent Office Report a few years since by Townsend Sharpless, of Philadelphia, only altering the arrangement of the tools on the walls by simply suspending them vertically. The painted outline of each tool at its place of hanging instantly admonishes any careless hand that he has left his tool out of place, and it has been found a most efficient means of keeping everything where it belongs.

ON THE MANUFACTURE OF FLOUR.

BY WILLIAM WARDER, OF SPRINGFIELD, OHIO.

The production of wheat has so rapidly increased that a review of the present condition and future prospects of its manufacture becomes deeply interesting and eminently proper in a history of the agriculture of our country. At the end of the last century, and early in the present, under the lead of Evans, Ellicot, and others, great improvements were made in flour mills. Not

only were these improvements in the style and finish of manufacture, but still more in the ease and consequent cheapness with which so heavy a commodity was carried through its various processes. The wheat and meal were "elevated" and "conveyed" into different parts of the mill. "Furrows" were introduced into the faces of the stones, which were consequently run at far higher speeds, and the meal was more rapidly ground; and the "hopper boy" was replaced by his mechanical substitute for feeding the bolts. These are a few, but the principal improvements which mark that day—they were great improvements, and seem to have satisfied the manufacturers of flour for a long series of years, and, except in minor details, the work of Oliver Evans laid down the rules by which succeeding mills were built.

Within a few years past the margin of profits has so rapidly decreased, arising from various causes, but more especially from the demand for wheat rather than flour for export, that when the present Congress formed its system of taxation, it was found that this branch would be seriously crippled by the imposition of a tax of ten cents per barrel, and it became necessary to relieve it from any burdens of this kind. From whatever causes this reduction in profits to the miller may arise, it is an evidence of good and a cause of good; an evidence that the producer is receiving the very highest price for his wheat, and, on the other hand, a spur to invention and to economy in manufacture. We may fairly state that the lethargy which has for so many years surrounded such a very important branch of business has now been cast aside, and an interest aroused from which we may augur the most important results.

In this short article we have thought that rather than give a description of the present condition of milling, it would be better to point out where it is defective, and where we should seek to improve our manipulations, premising, however, that many of these have already been introduced into mills, but they have not received that general attention which their importance deserves.

In the first place, the mill should be constructed for the purpose of holding the machinery, and not be turned into a warehouse for the storage of grain. This has been adopted in some instances, but is not general, and new mills are constantly built which have no other storage room than that which is afforded in the same building. This is a grave error. No machinery can run truly and properly under the varying effects of a greater or lesser amount of wheat stored in the same building and on the same foundation. In cities, where the supplies are not expected to be large, this does not make so much difference; but in the country, where supplies must be obtained when offered, and where thirty thousand bushels or more are put in the mill at one time, such a weight will necessarily derange the whole of the machinery. The warehouse should be built as near the mill as practicable, but on a different and independent foundation.

In the next place, greater attention should be shown as to the relative height and breadth of the mill building, so that in elevating wheat or meal it may be spouted into every portion where it may be needed to be taken, without the intervention of conveyers, often a needless expense of money and power, if a proper height had been originally given to the building. Here let us add that, as the decrease in profits and the hopes of increasing them is the spur to all improvements, economy of power and of manual labor is always to be borne in mind in the arrangement of the mill. Very much may be saved in this way in original cost, in power used, and in the amount of manual labor, and its presence or absence measures the mind of the master who directs its construction. In some of our mills nearly one-half of the shafting and machinery might have been avoided if originally better planned. So, also, with the duties of the miller, which are so scattered and so poorly arranged that whilst attending to one duty others equally important are neglected. The cleaning of the wheat, the grinding, and the bolting, are equally important, and, so far as possible, they should all, at the same time, be under the command of the eye and ear of

the miller on duty. In proportion as these points are observed so is labor saved, and saved without the sacrifice of careful manipulation. So, also, should be observed with equal care an economy of labor in receiving the wheat, in packing the flour, and in the disposition of the offals. The expense of all may be greatly lessened, and that, too, without increasing the original cost of the mill. It all depends upon the arrangement of the different parts. We have laid great stress upon the attention which should be paid to economy, but no more than it deserves. Our margin of profits is, in a great measure, destroyed by the foreign miller coming to our very doors and buying the wheat which we should manufacture at home. It is unnecessary for us here to enter into an explanation of the causes of this state of things; it is sufficient for our purposes to know the fact. To remedy the evil we must manufacture more cheaply, and manufacture better than the foreign miller. This we can and must do. We have heretofore led in improvements in mills, and our mills are even now better than those abroad. But this is not sufficient. We must make them very much better, in order to preserve our foreign trade in flour; and by the economy of our manufacture, and by the superiority of our flour, make it to the interest of our exporters to send abroad the manufactured rather than the raw material. Look at that vast stream of wheat flowing in that form towards Europe; every bushel of it should be manufactured here, the profits of manufacture saved here, the offals be fed here, and the barrels be made from our own timber. Here is an object for which we should struggle, and that, too, with all our might. How can we attain the prize? The answer is plain. Economize the expense of every process of manufacture, and make more and better flour from the same amount of stock. We do not wish, however, in our remarks, to be understood as advocating a reduction in wages. Far otherwise. Intelligent labor is always the cheapest. Thorough economy in manufacture cannot be made without the best talent, and talent in every line of business should be encouraged and rewarded. What we mean is this: Do not waste your capital and power by building and driving unnecessary machinery. Apply that wasted power to increased production, (it requires no more attention;) arrange every part of the mill so that it may be carried on with the least manual labor; bring all the processes as near together as possible, so that whilst one is being attended to the others will not be neglected; and improve the grade of your flour. This is the economy we advocate. The mill being suitably arranged, the next object to be attained is to increase the amount and quality of flour; and, for this purpose, there is the cleaning of the wheat, the grinding, and the bolting, each in a near measure equally important, and, unless great care is observed in each, no really successful results can be expected.

In cleaning wheat many difficulties arise. The staple comes from the farmer mixed with many foreign substances, sticks, straws, stones, rye, barley, oats, cockle, chess, smut, &c. These can only be removed by processes particularly adapted to each. In the only mills in which we have known wheat to be really well cleaned the different machines were so numerous as to encumber the mill, and being scattered, they greatly increased the labors of the miller. We think there is room for great improvement here, and if a machine could be constructed to combine the various processes in a compact form, without sacrificing their efficiency, it would be a great desideratum. We are apt to expect too much from the single machines now in use, and too much is promised for them by their builders. Screens are good as far as they go, and so are blast-fans. Suction-fans were a great improvement, and are the main dependence for light dirt, but they are, from very necessity, limited in their power. A very small stream of wheat only can be cleaned in a suction-fan, and if more is required the fans must be multiplied, or the operation must be again and again repeated. In cleaning wheat the separations should be made before it goes to the scourers, the sticks and stones be removed, and the smut and rat-balls carried off un-

broken; then, when passed through the scourers, the beard with the adhering dirt can be easily removed. When these separations are thoroughly performed the scouring of the wheat is easily accomplished, and there are many machines which would give satisfaction. There is a prejudice in the minds of some millers against thorough cleaning; they think the weight of their yields may be lessened by throwing away so much that would otherwise go into the flour. Without more than adverting to the morality of the question, and the but decent honesty which should impel every one engaged in manufacturing food for man to render it as clean and wholesome as possible, we think such a miller mistakes his interests. He certainly cannot make a good grade of flour, and we do not think as much. The cleaner and the more even the stock the better it can be ground and the more thoroughly it can be bolted, and the latter process can be carried on until the very least possible amount of flour is left in the offal. This cannot be done where you have foreign substances to contend with.

The wheat being cleaned, we next proceed to the grinding. We think there is here less cause to complain than in any other branch of the business. Our millers, as a general rule, can grind well, and when there is neglect it is but too often caused by the ill-arrangement of the mill, which calls the miller too much from his post. There are some interesting questions yet to be definitely solved in reference to the best size of the stones, the speed with which they should be run, and especially the shape, position, number, and draught of the furrows. The action of the stones on the meal and the course of the meal through the stones form some very beautiful problems for the mathematician, and well worthy of his study. He might throw a light upon and solve long-mooted questions, which would be of great value to the miller. In using coarse bolting cloths, the ill effects of uneven grinding are hardly felt, but with fine cloths the run of "seconds" becomes so heavy that the use of fine cloths is disparaged, when the greater portion of the fault lies in the bad grinding.

We now approach a branch of milling in which the greatest advance has been made in the past, and where we may expect the greatest improvement in the future; we refer to the bolting of the flour. We approach this subject with hesitation, for we know its importance, and that here is the end and measure of the miller's skill. We are also well aware of the diversity of views held by millers, and the numerous different modes that have been tried, and the warm advocates which each possess, and that very beautiful flour is made by many as proof of these theories. Mere superiority, however, of the first grade of flour is not the only test, and, under the present condition of the trade, possibly not the most important. What are the yields per bushel, and how great a percentage of first grade is produced, and the relative value of the second grade? Until these questions are solved by more accurate tests than are yet made, and from trials of the same kind and quality of wheat, we are left to theory and private judgment to guide us. It is a lamentable fact, and one we must urge upon our millers to correct, that but few make any tests of their yields, and that the amount of stock required to make a barrel of flour is not known with any sure accuracy. Until this is corrected, and as long as we carry on our business blindfolded, how can we expect improvement?

In nothing are the present mills more marked, in their difference to those of the past, than in the great increase of bolting cloth used in making a given amount of flour. When we remember the small amount formerly used, and how coarse and irregularly it was woven, we are surprised that they should ever have made flour counted as superior, and still more at the positiveness with which some of our dear old grandmothers assert that the flour of the present day cannot be compared to that of "old times." We must, however, remember the large amount of stock then required to make a barrel of flour. Not only have we increased the quantity of cloth, but we use much finer

numbers than formerly, and here commence our troubles. Bolting cloth is made of silk threads covered with gum, to make a smooth, hard surface to facilitate the passage of the flour through the meshes. The meal, fresh from the stones, is hot—much hotter than formerly, when stones were run at lower speeds; as the mills are increased in capacity, there is less facility for cooling this meal before it goes into the bolting chest. The action of this heat is to soften the gum on the threads, making it sticky, with a tendency to retard, rather than aid, the passage of the flour; furthermore, as the air becomes warmer the more moisture it will absorb, and the air in the chest becomes so surcharged with dampness as to swell the threads of the cloth by this much lessening the size of the mesh, and still more interfering with the bolting. This is a very trying evil to the miller, and it has been one great obstacle to the use of fine cloths. A favorite mode of overcoming this difficulty is by the use of what are called "knockers," which, striking continually the ribs of the reel, *jolt* the flour through; this does not, however, remove the *cause* of the difficulty, and has a tendency to "speck" the flour. Every housekeeper who has ever used the common hand-seive knows from experience that the more gently it is used the better the sieving is done, and though a tap on the side of the sieve will increase the quantity, it is at the expense of the quality of the work.

The continued ventilation of the bolting chest by the admission of cool, dry air. and especially if this should be increased to a strong current passing through the cloth, thus hardening the gum, keeping the thread dry and its original size, and at the same time carrying with the current of air the floating dust of flour which otherwise would hang upon and cloud the cloth, was an obvious remedy, and has been tried; but there were found to be so many and such serious difficulties to be overcome, that until the improvements of Mr. William F. Cochrane were introduced the use of fine cloths where much flour was required to be made and continuously, without reference to the temperature and the condition of the wheat, was by no means safe, and, in fact, was impracticable. With the aid of these improvements, which are marked with great originality of thought, simplicity of design, and a wonderful adaptation to the objects to be attained, the use of the very finest cloths becomes eminently practicable in mills of the largest capacity, and a quality and quantity of first grade flour can be obtained, we think, entirely beyond any other mode of bolting. We are convinced that by the aid of fine cloths a greater percentage of high grade flour can be made, and further, that to avoid "speck," the operations of bolting must not be forced but carried on by gentle means, and that the solution of these difficulties is through the aid of a current of air passing through the cloth and through and out of the chest, aiding the bolting and carrying off the moisture. When we furthermore remember that the greatest difficulty in the choking of the cloths is immediately after harvest, when the crop is coming in most rapidly, and when the miller is most desirous of manufacturing rapidly, the importance of the improvement becomes the more apparent. With the use of fine cloths, however, must not be neglected the improvement in grinding, for any irregularity will be shown in the increased quantity of second grade flour to the injury of the first grade, for the first grade, if from meal too much ground, is apt to be "clammy" and "lifeless." Good cleaning, good grinding, and good bolting on fine cloths, must go hand in hand together.

In the older forms of bolting chests, the richest portion of the offals, called "returns," were carried to the head of the first reel, and again passed through that reel; all the flour was made on this one reel; it is now considered more proper to pass it to one or more other reels, where it may be treated on other cloths, and in a manner especially adapted to its condition, and where only so much of the flour suitable for first grade may be separated from that which

should go with the second grade. It is in view of these processes that fine cloths become valuable, for it enables us from impoverished meal to obtain a clear flour, which could not otherwise be done. The quality of the first grade flour being the same, the percentage, or number of pounds per bushel of wheat, is the measure of success. This percentage of first grade to second varies very greatly in different mills; even where the first grade is intended to be of the same quality, we are certain that in all it is much less than it might be. We are well aware there is a limit beyond which we cannot pass without deteriorating our flour by the too great admixture of "middlings," but we do not think that limit has yet been reached.

After the first grade of flour has been made, there yet remains the "middlings" to be treated; by this term is generally included all of the richest offals from which we expect to make a second and, in some mills, a third and fourth, grade of flour. We believe a more proper term to apply would be "seconds," and that "middlings," properly so called, is, in its nature, different from the starchy body of the grain from which is made the finest flour. We think it is made from the germs of the grain; it is tenacious and difficult to grind, rolling out into vermicelli under the action of the stones. It is sweet to the taste, and, however clear of offal, the flour made from it doughs up of a dark color, and is so characteristic that flour with any large quantity in it is always easily distinguished. If the processes of grinding and bolting were carried on in perfection, there would be left but a small percentage of this grade; under the present methods the seconds are mixed with so much badly-ground meal, which is too coarse to pass through the cloths, and so much of fine flour which has been left by imperfect bolting, the amount which is to be treated becomes very considerable. In the treatment of these "seconds" and "middlings" we believe there is as yet less skill shown than in any other branch of milling. We believe that instead of being immediately re-ground they should be treated with suitable cloths, and "cleared up" in this way as far as possible, and that only that portion should be re-ground which cannot, in any other way, be "cleared up." Our experience would indicate that re-grinding has an injurious effect upon the product, and that it loses in color and quantity by it, and further that it requires as much or more cloth to treat the seconds than to make the first grade of flour, and think it may be laid down as a rule, that where two or more grades of flour are produced, and the second grade doughs up white and clear, that there is a too large admixture of meal that should have been worked into the first grade, and is a proof that the percentage of first grade is not as large as it should and could have been made by better processes of manufacture.

The flour having been made, as much of the first grade as possible, and the second as well treated as its low character will admit, we will again turn our remarks to the economic management of the mill—to the packing of the flour and the handling of the offals. Of course, hand packing is no longer to be thought of. We are not altogether satisfied with any of the devices now used; that of the augur pattern is probably most used, but an objection has been urged against it which, we think, should be considered, viz: the flour in the centre of the barrel is not sufficiently pressed, leaving a loose column there; this is particularly observable with the rollers where they are used for packing. This difficulty, we think, could be rectified with a little care.

There yet remain to be mentioned the offals, the last product of the mill, not the least important to the miller, when, as is too often the case, all the other products are required to pay the cost of stock and labor, and he finds his profits, if anywhere to be found, in his bran pile. These offals are bulky, and the labor in handling them should be reduced as much as possible by stocking them in garners where they may be drawn down with the least possible labor. The value of bran as a food for young and growing stock can scarcely be too highly recommended. For young mules and colts it is particularly adapted. It is

of easy digestion, and gives growth without the tendency to fatten that lies in the too gross corn with which they are so often fed. The French chemists have made some valuable discoveries in their analyses of wheat bran, and they have found in it a product which they have denominated "cerealine," which is found to dissolve all other kinds of food when subjected with it to warmth and moisture, and consequently is a great aid to digestion. This is proved to be true by the use of Graham bread, which is made from unbolted meal, and in which the bran is retained. It has also been tested in feeding it to young stock with the very best results. This point, however, can only, like many others to which we have referred in this article, be merely noticed, leaving it for others to experiment and to record, in a fuller manner, their experiences. The subject of milling is too broad and its manufacture too intricate—its results too important to be treated in a short article. Only the more important features can be pointed out; the details would fill a volume, and must be left to other hands. If we have proved that the present manner of manufacture is imperfect, and may be improved very greatly by improved processes, we have attained all that we have designed by our remarks.

COAL OIL.

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The object of this paper is to discuss, within the smallest compass—1st, the composition and qualities of coal oil; 2d, its manufacture, use in the arts, and statistics of trade; 3d, the history of its discovery as a natural production; and 4th, the theory of its origin favored by geologists.

1. THE COMPOSITION OF COAL OIL.

All oils are combinations of hydrogen and carbon. They burn by the addition of oxygen, for which carbon has a greater affinity than for hydrogen under the circumstances attending combustion; whereas, under the circumstances attending life or the energetic creation of cellular tissue, the affinities are seemingly reversed, and hydrocarbons are produced; but, in fact, while the inhaled air oxydizes one portion of the blood, carbon, another portion, protected from oxydation, is uniting with the fluids of the body and forming fat or oils. Hence the hydrocarbons, *i. e.*, the solid, fluid and gaseous oils, characterize the animal and vegetable kingdoms; and wherever they are found in the rocks, even of the oldest date, they must be accepted as proofs of the former existence of life at the surface as it then was. Hence, also, the division into animal and vegetable oils, and an uncertainty whether some pit oils may not fall into the former category.

Most oils in a state of nature contain other ingredients and impurities. The solid coals contain water and small quantities of nitrogen, sulphur, phosphorus, lime, and the alkalies, with considerable quantities of earthy bases forming their ash. The rosins contain sometimes one-third of oxygen. The liquid oils are sometimes made up as much of oxygen as hydrogen, as, *e. g.*, the oils of sweet almonds, linseed, walnut, olive, fish, potatos, castor bean, &c., the first containing 77.4 carbon, 11.5 hydrogen, 10.8 oxygen; the last, 65.0 carbon,

10.6 hydrogen, 24.3 oxygen. Some oils, like that of the codfish, employ their oxygen for various acids, such as oleic, margaric, butyric, acetic, fellinic, cholinic, bilifellinic, phosphoric, sulphuric, all of which are present together in that oil, with small quantities of iodine, chlorine, bromine, soda, lime, and magnesia.

In oils distilled from coal, such as Kyanol and Leucol, nitrogen instead of oxygen exists in a proportion almost double that of the hydrogen—77.3 + 7.6 + 15.0.

The various proportions in which the hydrogen and carbon unite cause the production of various oily principles, to which various names are given, as Petrolene, C^{10} H^{8}, (88 + 12;) Benzoene, C^{14} H^{8}, (91 + 9;) Asphaltene, C^{20} H^{16} O^{3}, (75 + 10 + 15;) Paraffine, C^{24} H^{50}, (85 + 15;) Naphthaline, C^{10} H^{4}, (94 + 6.) When these principles combine they form, *e. g.*, the Asphalt of Bechelbronn, considered by Boussingault to be a union of Petrolene 85.4 + Asphaltene 14.6. Every locality seems to furnish peculiar varieties of oil, due to the variety of these combinations and suited to different purposes in the arts; and the oils coming from different geological horizons differ much. The oils from south of Lake Erie are more explosible than those from the Canadian peninsula. The color ranges from straw, through amber, to jet black, and the consistency from the fluidity of naphtha to the viscidity of tar. Some oils are greenish, and others reddish in hue. Their specific gravities range on Beaume's hydrometer from 46° to 26°, (sp. g. 0.90.) The American samples tested in Manchester by O'Neil were generally below 0.816. The range of volatility or the limit of explosibility is equally great. Of the samples tested by the Manchester Sanitary Commission, two formed an explosive vapor with air at 60° Fahrenheit, four at 100° Fahrenheit, three at 120° Fahrenheit, twenty at 150°. Nine samples out of thirty-two were pronounced dangerously unsafe. Specific gravity was no test of safety; nor was the boiling point, since, for example, coal naphtha boils at 260° Fahrenheit, but instantly explodes at 32° Fahrenheit. The British government has lately legislated virtually to prohibit the importation of those oils which explode at or under 100° Fahrenheit.

Pure unoxydized petroleum or naphtha becomes oxydized by exposure in the earth into the thicker or solid asphalts or bitumens, as the pure hydrocarbons of the tree oxydize and harden into resin or gum. Sterry Hunt considers the mean composition of petroleum to be equal equivalents of hydrogen and carbon, quoting the analysis of Uelsman, De la Rue, and Müller, and explaining, after Bischof, how the buried vegetation of the past would be converted by simple evolution of marsh gas (air being excluded) into bituminous coals and anthracite, without the intervention of a high temperature.

When steam is passed through tar it takes along and condenses afterwards naphtha 9 parts in a hundred; of the remainder, 60 parts are dead oil, and 31 parts pitch. The naphtha is divisible in basic oils, acid oils, and neutral oils. To purify it sulphuric acid is added; it throws down the basic oils in the form of "sludge," from which the coal tar colors are produced. The most volatile portions of the naphtha are the acid oils—carbolic acid, C^{12} H^{6} O^{2}, and cressylic acid, C^{14} H^{8} O^{2}, which, when united, form creosote. Solid carbolic acid is the most powerful disinfectant. Treated with nitric acid it forms carbazotic acid, a beautiful yellow dye, as well as a powerful antiperiodic substitute for quinine. The third portion of the naphtha contains the neutral oils—benzol, toluol, xylol, cumol, cymbol, &c., &c., hydrocarbons of different volatilities. Benzol, C^{12} H^{6}, boiling first, (at 177° Fahrenheit,) is the most useful of these substances, being also obtained easily by simple distillation with steam. With nitric acid it forms nitro-benzol, the substitute now for bitter almonds, and the basis of our tar colors; for with water and iron (C^{12} H^{6} (N O^{4}) + 2 H O + 4 Fe) there results aniline, (C^{12} H^{7} N,) throwing down peroxide of iron. Aniline is a compound ammonia, in which phenyle (C^{12} H^{5}) replaces one of the three (H + H + H) +

(N) in ammonia. From aniline is obtained mauve, magenta, roseine, azuline, blue de Paris, &c., &c., composing the series of blues and reds, which, with the yellow before described, make up the coal-oil rainbow.*

2. THE MANUFACTURE, USES, AND STATISTICS OF COAL OIL.

The manufacture of coal oil has been essentially described, and some of its uses in the arts hinted at in the previous section. But the production of the oil itself from coal, peat, boghead cannel, cannel shales, and other bituminiferous minerals, required a manufacture, previous to the discovery of the well oil, which consisted radically in a coking process, during which the volatile ingredients distilled over. The first patents for this process in England date 1694 and 1716. Dr. Clayton's experiments, by which he obtained by distillation "a phlegm, a black oil, and an incondensible spirit," were published in 1739. Oil distilled from stone is mentioned in Lewis's Materia Medica, 1761, and its only practical application seems to have been to medicine. A French patent was granted to Chervan in 1824. But when Reichenbach, of Moravia, published, in 1830–'31, the nature of the various products of the destructive distillation of coal, and described paraffine first got from wood tar, distinguishing it from naphthaline, the basis of illuminating gas, then the attention of western chemists was aroused to the importance of the subject. In 1832 Blum and Moneuse patented, and Lawrent and Selligue began to investigate, the coal oil gas manufacture, their publications running from 1834 to 1845, exhausting the description. The specification of the patent of March 19, 1845, (*Brevets d'Invention*, new series, iv., 30, translated in Du Buisson's specification, No. 10,726, English Patent Office) is pronounced by Hodge incomparable.

James Young, of Glasgow, in 1847, introduced the distillation process into England, and applied it to boghead cannel, from which he obtained, in 1854, an annual yield of oil equal to 8,000 gallons, selling for £100,000, most of which was profit. In 1854 the Kerosene Oil Works, on Long Island, introduced the distilling process into America, and in 1856 the Breckenridge Oil Works, at Cloverport, Kentucky, distilled from cannel coal found there. By the close of 1860 there were 25 factories in Ohio; 6 in Kentucky; 8 or 10 in Virginia; 10 in Pennsylvania; 1 in St. Louis; 5 near New York city; 1 at Hartford; 4 near Boston; 1 at New Bedford, and 1 in Portland, each averaging perhaps, 300 gallons of light oils per day; the boghead cannel yielding 75 refined from 130 gallons of crude oil per ton, and the American cannels 60 from 117. The Albert coal yields, however, 75 from 110. Now that the natural crude oil issues from the earth in such abundance, the first distilling process is abandoned, and these factories are occupied in refining only. It is, therefore, not necessary to describe the various forms of retort—D-shaped, iron or earthen, rotary, &c., or the method by coke pits and condensers, or by kilns.

The refining process requires stills holding, say, 1,500 gallons of crude oil, made of boiler plate, with cast-iron bottoms two inches thick, on which the coke crust is deposited eight or ten inches deep, and is used as fuel after being removed. The heat continues twenty-four hours, and rises gradually to 800° Fahrenheit. A steady flow of oil proceeds from the end of the worm, the condensation of paraffine in which, towards the end of the process, is carefully prevented. Of the whole oil 88 to 90 per cent. comes over, and is then further purified with 5 to 6 per cent. of sulphuric acid in "agitators." Three thousand gallons of oil are kept stirred for a while, and then left to settle, the salts being tapped at the bottom. Agitated again with water, and again tapped from

* M. Tournet has lately demonstrated that the brilliant colors of gems, such as the emerald, aqua-marina, and amethyst, are due to the diffused presence of hydrocarbons. They are, in fact, a natural production of the aniline colors in coal tar, and not, as once thought, metallic lustres.

below, the oil is agitated a third time with strong alkali, washed again, and then transferred to the second set of stills like the first. Thus is produced, first, the limpid merchantable illuminating oils below 0.820, constituting from 30 to even 90 per cent. of the whole; then follow heavier oils sold to the machine shops and railroads, or re-distilled into light oils and paraffine; finally comes over the dark-colored paraffine oils, which, when left to stand cold in vats exposed to air, deposit paraffine in silvery scales, to be itself pressed and purified with acid, hot water, and alkali. The illuminating oils are deprived of odor by standing for some days in shallow vats over alkaline solutions. Light destroys also the color, but yellowish oil at 60 cents is worth more for lamp use than colorless oil at 75. (Hodge.)

Ammonia is extensively manufactured from the English gas-water, which contains it in combination with the volatile acids, sulphuretted hydrogen, and carbonic acid, and in the form of chloride of ammonium. Ten gallons of this water are distilled from a ton of Newcastle coal. The sulphide and carbonate are reduced by muriatic acid. Four thousand tons of the crystallized muriate are made annually in England. Benzine or eupion, one of the products of coal oil distillation, more explosive than turpentine, has supplanted the latter in the arts since the great rebellion has diminished almost to nothing the production of the southern pine forests. Hence explosions and conflagrations are more numerous. The demand for benzine in England has become unlimited, especially in early and late spring. It is quoted at 2*s.* 6*d.* to 2*s.* 9*d.* per gallon in casks. American, *i. e.*, United States petroleum, containing much more benzine than Canadian petroleum, rules $10 a ton higher on that account.—(Liverpool, September 20, 1862.) The lubricating oils sent over to England have been as yet but the stingy remains of the absorbing demand in the United States, and are complained of as very mucilaginous, only semiliquid or else altogether too light. The oilometer, and not the hydrometer, should be the guide, ranging sperm at 45°, olive, rape and lard at 27°, 28°, as at the two extremes of practical lubrication. This lowest density, however black, if free from grit, will fetch £15 per ton; green, £17 10*s.* to £20; brown, £20 to £22 10*s.*, and yellow up to £30.—(Philadelphia Coal Oil Circular, 1862.)

Mr. Dollfuss, of Mulhouse, applies Lebel's asphalt oil to the inner surface of boilers and heaters, detaching thereby calc crusts, cleansing a 45-horse power boiler with 20 pounds of oil. Repairs to the boiler are less frequent.—(Franklin Institute Journal, 1862, p. 399.)

As a fuel, petroleum enters into numerous French patents. The people of the Caspian mix it with clay; the Norwegians with sawdust and clay. The refuse charcoal of the French furnaces is mixed with charred peat or spent tar, and tar or pitch is added, and the whole ground and coked. As an illuminating agent coal oil is fast supplanting the animal and vegetable oils. It has always been a lamp oil of India. It lights the streets of Genoa; but its natural odor is so disgusting that its use in Europe was, for a long while after its discovery in Lombardy, interdicted. Since the refining process was discovered, the trade has spread to every city of the Old and New World, and the annual number of patents for new forms of lamp and new kinds of candle shows how completely the kerosenes and paraffines are banishing the whale oils and tallows from the market. The outlet for the coal oil wax in England and on the continent is said to be very large, not less than twenty tons per week being condensed from boghead cannel alone. "The superiority of the petroleum over the paraffine wax is admitted by consumers of every kind, insolubility being the proof of merit." The cold weather in America is favorable to this manufacture.

Before going on to the supply and demand, which is especially governed by the call for an illuminating agent, it must not be omitted that coal oil, crude, has been always a medicine; in more general use in eastern countries, and in

ancient times, because magical qualities were ascribed to it. So also among the North American Indians it has always been a great medicine, and the white settlers have learned to prescribe Seneca oil for many diseases. Flowing from the solid rocks, it has offered healing virtue without money and without labor.

The number of persons handling coal oil is estimated at from 30,000 to 50,000. Its effect upon the health has been a subject of much speculation. Mr. E. G. Kelly, a chemist, writing to the Scientific American, says that his men sleep and live in the factory and enjoy remarkably good health, some of them becoming fleshy and robust who were not so before. Weak lungs and asthmatic constitutions find great relief from inhaling the petroleum vapour.

The natural supply of coal oil must now be described. Its history will come in the following section. It has rendered the manufacture from coal, &c., needless; it leaves the refining machinery still at work, and multiplies their stills and vats indefinitely. The quantities of crude oil produced by nature are astonishing. The earth literally spouts oil as a whale spouts brine. The Empire spring sent its oil up to a reservoir three hundred feet above the level of its mouth. The Phillipps well yielded at first three thousand barrels of oil daily, while others around it were also yielding from five hundred to fifty barrels each per day. Previous to July 10, 1862, this well continued to yield from 500 to 600 barrels per day for three months. The Excelsior well flowed 500 barrels per day. The wells on Oil creek alone are estimated as at present producing nine hundred thousand barrels per annum. In Canada three hundred Enniskillen wells, on Black creek, in a plot of two square miles, produce a still larger amount, the minimum yield being ten barrels, of forty gallons each, per day, while one of the wells spouted for many days after it was finished from ten to twelve thousand barrels per day. Another was only second to it in profusion, and, with five or six others, has continued for several months to pour forth continuous uniform floods of the precious liquid, much of which has run to waste here, as in older oil regions, from improvidence in not preparing reservoirs, and from the physical impossibility of procuring an adequate supply of barrels. Empty oil barrels were, as late as November, 1862, returned from Philadelphia to Pittsburg, *en route* for the oil region, in immense numbers, at a freight of a dollar a barrel. Villages of barrel-makers have sprung up in the different oil regions, just as cities of potters line the banks of the Irrawaddy, for it requires 6,000 hands to turn out 15,000 barrels per day. There were in July, 1862, thirty-one flowing wells on Oil creek, in eight miles above its mouth, yielding four thousand barrels daily, and it is said that instances are not uncommon of pumping wells becoming suddenly flowing wells, and thereby largely increasing their production. In estimating the magnitude of this new supply, it is well to compare the fact that the entire production of the whale fishery of the world, in one of its most prolific years, was not quite four hundred and thirty thousand barrels of sperm and whale oil together.

Whether the natural supply of rock oil will be diminished in coming time is a question of moment to the speculator, and of interest to the economist and geologist. The force with which new borings often permit the deep-set reservoirs of oil and gas to evacuate themselves, would seem itself to state the physical impossibility of its continuance; and experience has shown that all the older wells slowly diminished their supply. Hall states, in describing the old Freedom spring, in Cattaraugus county, New York, that a well was dug 14 feet deep, 18 feet distant, which afforded at first a large supply of oil, but soon the old and the new springs died away together. Few, perhaps none, of the old salt wells of the Sandy, the Kanawha, the Monongahela, Conemaugh, Alleghany, Beaver, and Muskingum valleys have been retained in full working condition, except by being deepened from time to time. The boring being carried further down every few years, new supplies of brine and oil and gas

have been the consequence. The fiercest blowing and spouting wells of the last two years have become comparatively quiet. There is every geological reason for believing that the number and the age of neighboring wells are the two elements of the calculation to determine their capacity.

When a comparison with other regions of the world is instituted, the same conclusion is arrived at. The five hundred and twenty springs of Yanang-houng, on the Irrawaddy, yield now only one hundred and twenty thousand gallons of petroleum per annum. Cases of sudden exhaustion also have occurred, when wells, beginning to blow off gas, have, in a few days, become quite dead in all respects. It is also asserted that, in every case of conflagration, the burning well has ceased its yield of oil, as if internally injured, by the cracking of the walls or by the loss of gas. On the other hand, old wells, exhausted by long practice and abandoned, have become refreshed by rest and profitable.

The growth of the supply at present is enormous, whatever may be its future diminution. A railroad is building from Oil City for its sole accommodation. The Erie railroad, which carried only three hundred and twenty-five barrels to New York in 1859, carried 134,927 in 1861, and 278,923 in 1862—5,364 carloads, of 52 barrels each; equal to 11,156,920 gallons, worth $2,510,302. The demand, like the demand for coal itself, must always run ahead of the supply which it calls after it. The consumption of coal oil for the world was estimated to be, in 1860, fifteen millions of gallons; in 1861, twenty millions in 1862, fifty millions. The London Times roughly estimates the export to Europe alone, in 1863, at fifty to sixty millions. The low prices ruling early in 1862 sent *trial* cargoes all over Europe, to the extent of five millions, and established the trade in every city. The experiments with Thompson's patent for making gas, at St. Catharine's, Canada West, and at Homer and Cortland, New York, proving that cheap illumination* was to be got from coal oil, increased at once the European demand.

The following table will show how the exportation from New York proceeds in different seasons of the year, as well as its marvellous advancement:

Month.	1861.	1862.	Weekly statement in November and December, 1862.	
	Gallons.	*Gallons.*		*Gallons.*
January	19,794	375,011	November 7	217,245
February	16,066	322,729	November 14	249,054
March	13,743	941,744	November 21	227,099
April	24,234	704,549	November 28	649,373
May	21,902	519,494	December 5	134,300
June	25,527	240,138	December 11	129,126
July	46,116	164,304	December 17	22,357
August	44,640	393,773	December 23	17,138
September	151,743	633,351	December 31	31,787
October	310,402	811,061	Showing the rapid decline of shipment.	
November	....	1,342,771		
December	....	334,708		
Total N. Y. export, 1862	....	5,783,664		

Of this quantity, about 1,600,000 gallons went to Liverpool, 1,100,000 to London, 900,000 to Antwerp, 700,000 to Havre, 600,000 to Bremen, 240,000 to Hamburg, 200,000 to Marseilles, 170,000 to Cork, 130,000 to Queenstown, 260,000 to Cuba, 300,000 to Australia.

* The Stephenson House, St. Catharine's, burns 180 flames for 86 cents per night.—(Phil. Coal Oil Circular, December 6, 1862, 1st page. Full discussion.)

The range of prices from month to month, not only at the distant centres of consumption, but at the centres of production, is extraordinary, both for the length and speed of its movement. The opening of new wells, the destruction of others by fire, the losses sustained in the artificial communication by water, and the alternate drain and glut of the market, have together kept the traffic in coal oil a hazardous speculation. In London, November 28, 1862, crude oil sold in barrels at £19 to £19 10*s*., and immediately afterwards, on receipt of American news, went up to £22; refined being 2*s*. 6*d*. to 2*s*. 9*d*. In Liverpool £22 were refused in large lots, and a new rise took place to £24; refined, 3*s*. In Pittsburg, the accidents of the river and of Oil creek make the quotations dance up and down three prices. On December 13, 1862, crude oil in barrels sold there at 33 to 35 cents, and in bulk 30 to 32½ cents; refined: pale straw, 70 to 75 cents; white, 80 cents. That day at Titusville, the emporium of the northwest Pennsylvania oil region, 500 barrels of crude oil sold at $12 50, and 1,500 more at $13. But at the wells the price varied from $5 50 to $7 50, according to location; the barrel itself being charged $2 75 to $3 extra, and hauling to Titusville $3 to $3 50 more.

The following table will show through what curves the Philadelphia prices ran in 1862, as given in the January (10th) number of the Philadelphia Coal Oil Circular, to the editor of which we owe so much for making the history and character of the subject clear.

1862.	Crude oil. Cents per gallon.	Refined oil. Cents per gallon.
Jan. 4	22½ to 23	37½ to 45
11	15½ to 20	30 to 40
18	18 to 19	30 to 37½
25	16 to 16½	28 to 35
Feb. 1	15 to 16	28 to 33
8	14 to 15	25 to 30
15	13 to 13½	23 to 28
22	12 to 13	23 to 27½
Mar. 1	12 to 12½	20 to 28
8	12½ to 14	25 to 32½
15	11 to 12½	25 to 33
22	10 to 12	25 to 32½
29	10 to 12	25 to 32
April 5	10 to 12	25 to 32
12	10 to 11	25 to 30
19	9½ to 10	21 to 28
26	9 to 10	21 to 27
May 3	9 to 10½	20 to 28
10	9 to 10	21 to 27½
17	8½ to 10	20 to 25
24	8½ to 9	20 to 26
31	8½ to 9	20 to 25
June 7	9 to 9½	22 to 26
14	8½ to 10	21 to 26
21	9 to 10	19 to 27
28	9¾ to 10¾	22 to 28
July 5	10 to 11	24 to 29
12	9¾ to 10¾	24 to 29
19	10 to 11	24 to 30
26	11 to 12	24 to 28
Aug. 2	11 to 13½	24 to 29
9	12 to 14	25 to 32
16	12½ to 15½	27 to 35
23	14½ to 16	30 to 37½
30	15 to 16½	32½ to 40
Sept 6	12½ to 14	32½ to 37½
13	12½ to 14	34 to 40
20	11½ to 13	35 to 40
27	12½ to 13	35 to 42½
Oct. 4	12½ to 14	35 to 42½
11	13 to 14	35 to 45
18	14 to 17	38 to 50
25	19 to 21	50 to 65
Nov. 1	18 to 21	47 to 62½
8	20 to 22	(Packages included) 55 to 65½
15	22 to 25	do 55 to 70
19	(Packages included) 40 to 45	do 90 to 112½
22	do 40 to 42½	do 75 to 95
29	do 38½ to 40	do 70 to 80
Dec. 6	do 35 to 40	do 70 to 82½
13	do 42½ to 50	do 70 to 82½
20	do 40 to 42½	do 62½ to 80
27	do 25 to 30	do 50 to 65
31	do 22½ to 25	do 45 to 55

3. THE HISTORY OF COAL OIL AND ITS DISCOVERY.

When we speak of the discovery of coal oil, in reference to late events, it must not be mistaken for a modern invention. The extraordinary attention drawn upon it by the discovery of a more abundant supply, by artificial wells, since the August of 1859, has made its previous history of comparatively little interest to one class of minds, but, on the other hand, has invested that previous history, to philosophic eyes, with all the charm of an archæological investigation. Did not the builders of Babel use clay for bricks and slime for mortar? (Gen. xi., 3.) It is evident from an examination of any of the ruins of Mesopotamia, that asphaltic mortar was the bed into which their alabaster wainscot pieces were set, and with which their vast terraces were compacted, and probably their roofs protected; the use of which so abundantly, only facilitated their destruction when the torch was at last applied. The pitch used was made by evaporating petroleum. That of Babylon we know was obtained from the sulphur, brine, and oil springs of Is; the products of which are still sold in the village of Hits. The story of the catastrophe of Sodom and Gomorrah, if not originated, was perpetuated by the vast accumulations of rock oil in the centre of the Dead Sea, as on the surface of a heated, simmering brine vat, where it is hardened by oxydation and drifted to the surrounding shores. A similar phenomenon—a lake of pure petroleum—elicited the amazement of the Spaniards who discovered Trinidad.

Oil springs, in fact, have been known and esteemed, and even worshipped, in every age and many countries. Herodotus describes a bitumen spring in Zacynthus, Zante, one of the Ionian Islands; and probably this spring sufficed the Egyptian nation for their incessant religious use of petroleum for mummies, the embalmment of which is amusingly described in Hunt's Merchants' Magazine for 1862. The "Greek fire" of more modern times was probably compounded of petroleum from the Zantean springs. Dioscorides tells us that rock oil was collected in Sicily and burned in the lamps of Agrigentum. The classic home of naphtha is Baku, a high peninsula on the western shore of the Caspian Sea, containing thirty-five villages and twenty thousand souls, rocky and sterile, without an attractive spot, without a stream, without one drop of sweet water except what falls directly from the clouds, and without a tree. But coal gas rises everywhere from a soil saturated with naphtha, and numerous volcanoes in action discharge volumes of mud. From the time of Zoroaster the naphtha of Baku has been sent all over Asia for the service of the sacred fire of the Parsees. The liquid streams spontaneously through the surface, and rises wherever a hole is bored. But especially at Balegan, six miles from the capital village, the sides of the mountain stream with black oils, which collect in reservoirs constructed in an unknown ancient time; while not far off, a spring of white oil gushes from the foot.

Upon their festival occasions the people pour tuns of this oil over the surface of the water in a bay of the Caspian, and then set, as it were, earth, sea, and sky in a blaze of light. Sometimes far grander exhibitions take place naturally. In 1817 a column of flame, six hundred yards in diameter, broke out near Balegan, and roared with boiling brine and ejaculated rocks for eighteen days together, until it raised a mound nine hundred feet in height. Of course, the population use the oil for light and fuel and coat their roofs with it. A clay pipe or hollow reed steeped in lime water, set upright in the floor of a dwelling, serves as a natural and sufficient gas-pipe. The Ghebers bottle it for foreign use; the Atecshjahns fire with it their lime-kilns and burn their dead. No wonder the religious sentiment of oriental mystics was entranced by such a land of fire as Baku, where in the fissures of the white and sulphurous soil the naphtha vapors flicker into flame; where a boiling lake is covered with a flame devoid of sensible heat; where after the warm showers of autumn

the surrounding country seems on fire; flames in enormous volumes rolling along the mountains with incredible velocity, or standing still expectant; where the October and November moons light up with an azure tint the entire west, and the Soghda-ku, Mount Paradise, the eastern buttress of the Caucasus, covers its upper half with a glowing robe; while if the night be moonless, innumerable jets of flame, isolated or in crowds, cover all the plains, leaving the mountains in obscurity. The Gheber and the chemist here may worship side by side. All the phenomena of distillation and combustion, under varying barometric and thermometric conditions of the atmosphere, may be studied; for none of this general fire burns unless when captured and applied to human uses in the lamp or stove or kiln. In the midst of this devouring element—through this world in flames—men live and love unharmed, tend sheep, plant onions, sleep, are born and die, as in more prosaic regions. The reeds and grass are in nowise affected by the flowing oil or by the burning gas. In fact, Rottiers, the traveller, thought the whole phenomenon electric, when he noticed that the vacuum in his thermometer tube seemed to be especially full of flame, and that the east wind put to quiet the whole exhibition; with which fact we may compare the curious discoveries of Moffat with his phosphorous thermometer, published in Silliman's Journal, December, 1862, p. 437, as bearing on his theory of two normal opposite air currents. From an equally remote era the Burman empire and northern Hindostan have received annual supplies of rock oil from the wells of the Himalayan valley of the Irrawaddy, through Rangoon; and it has always been a favorite drug in the Indian pharmacopœia.

In Italy, the oil wells of Parma and Modena date back nearly two centuries, the year 1640 being that assigned to their discovery. The springs of Ammiano have long lighted the streets of Genoa.

In France, oil springs have been known from time immemorial at Clermont and Gabian; and in Canton Neufchatel; and in Bavaria, Germany.

In the English coal mines, of course, the coal-oil gas—the dreadful fire-damp—was always a well-known demon to the mining population; but in 1659 Shirley, perhaps first, describes it to the reading public as an illuminating gas. In 1733 Sir James Lowther laid pipes along the mines and burned the gases at the surface of the earth. Dr. Clayton's retort experiments, to which we referred above, at the beginning of section 2, were six years later still. His "incondensible spirit" he burned in bladders for the amusement of his friends, as did Dundonald again in 1786, and Murdock in 1792. But the lighting of London streets and houses with gas came not till 1842. Twenty years have elapsed, and there are in Great Britain and Ireland 1,015 gas-works, with a capital of $90,000,000, charging an average of $1 80 per thousand cubic feet to small consumers, and deducting from five to thirty per cent. for heavy consumption. Some of these companies pay twelve per cent. dividends, and many of them ten per cent. The average capital of British gas-works is said to be nearly twenty per cent. less than that of American works.

In America the history of coal oil commences with the use which the white settlers found the Indians made of it for medicine, for paint, and for certain religious ceremonies. The settlers adopted its medicinal use alone, and retained for more than one affluent of the Alleghany river the Indian name of Oil creek. The one which has become so celebrated lately, enters the river a few miles above the town of Franklin. The oil was collected both by the natives and the whites by spreading blankets on the marshy pools which line the edges of the bottoms at the foot of steep hill-sides, or even mountain walls, such as hem in those valleys and support a table land of coal measures above. The remains of ancient pits, with notched logs for ladders, show how long the product has been valued by the aborigines. But although in all the valleys of western New York and Pennsylvania, eastern Ohio and Kentucky, and

northwestern Virginia, the evidences of the almost universal existence of the Seneca oil was known to the early settlers, its actual abundance underground was not dreamed of. Even long after the era of salt-well boring had begun, the isolated cases of spouting wells did not teach the truth as it is now known. Some of the oldest salt wells of the Pittsburg region, it is true, and of the Kanawha valley, yielded not only brine, but also oil and gas in great abundance; and in more than one place, and with a partial and temporary success, the gas was tubed off and led beneath the boiling vats for fuel. But it was too fitful in its escape to be relied upon; the oil which accompanied it was of no use, and when abundant a great nuisance. Hildreth describes the quantities of petroleum spouted from the salt well bored in 1819, in the valley of the Little Muskingum, in Ohio, and the tremendous explosions of gas which interrupted, sometimes for days together, the flow of brine. It was this fitful and ungovernable *vis a tergo*, having its unknown seat of power in the deep, which made every effort futile to employ the gas as fuel.

Travellers, however, report that this has been successfully done by the Chinese salt-makers for many centuries. As for the oil, continues Hildreth, it made for itself a local commerce, beginning to be in demand for lamps in workshops and manufactories, and the suggestion was already made that it would serve to light the streets of the cities of Ohio. It is not a little singular, says Mr. Hodge, that with the sources of supply thus pointed out, and the useful application of the petroleum understood, its value should have remained unappreciated, and, at the expiration of more than thirty-five years, be at last perceived through the progress of experiment made upon the distillation of bituminous shales and coal. But the fact seems to stand thus: the natural coal oil was a disgusting and imperfect thing, and there was neither the pressure of necessity nor the favor of science applicable, in Ohio, in the beginning of the century, to its purification. The destruction of the whale fishery, the increase of the railroad system, with its rolling gear and workshop machinery, and the coming in of lard oil as a substitute for whale oil, all had to intervene between the inception and the performance of the coal oil drama.

It was in 1847 that Mr. Young, in Glasgow, (the most intimate friend, by the way, of the African traveller, Livingstone,) had established his purification of petroleum from the Ridding's mines in Derbyshire, boghead cannel, common coal shales, peat and solid bitumen, and introduced the use of these mineral oils to such an extent that a search for the native article, long known to exist, was set on foot in earnest. The oils of the coal region of America at once commanded principal attention. The first practical movement in this direction was not made, until, in 1854, Messrs. Eveleth and Bissell, of New York, secured the right to the upper spring on Oil creek, and organized a company. Still, three years passed before Mr. Bowditch and Colonel Drake, of New Haven, began the first Titusville boring, striking the oil stratum at seventy-one feet depth in August, 1858. The drill sank suddenly into a cavity, and the oil rose within five inches of the surface, and was pumped off at the rate of, at first, 400 and afterwards 1,000 gallons per day. The news spread. The wildest speculation soon raged. Every acre of land in the valley, and part way up the steep hill-sides, for ten miles south of the boring, as far as to the junction of Oil creek with the Alleghany river, was bought up by eager contestants for a fortune sure to be realized in a few months. Hundreds of wells sank speedily to various depths. The once quiet, beautiful valley became a noisy den, a hideous desert. Derricks, scaffolds, and pumping gear took the places occupied by the tall forest trees or blooming orchards. Groups of warehouses, barrel factories, boarding-houses, and whole villages replaced each solitary farm-house. The stream was dammed and sluiced for artificial floods, harbors were excavated in the lowest places, and the rest of the intervale became a stinking bog of mud and salt mingled with oil. Not a blade of grass

was to be seen, and nothing to be heard but the clanking of the pumps, the blowing of some new well in its first energy, the shouting of drivers urging miserable mules and horses through the nauseous mud, dragging empty barrels to the wells, or full ones down to the stream, where the boatmen fasten them together for the next flood. Long barges filled with casks, or with the oil itself in bulk, lie waiting for the moving of the waters, when the upper dam is opened. Among them are to be seen strange crafts, composed of barrels lashed together like a raft, or barrels sawed in two and lashed together thus, to carry the oil in bulk, and filled to the brim.

Occasionally the pond freshets, as they are called, become scenes of ludicrous disaster. The latest were those of December 2 and December 5, 1862, in which fifty thousand barrels of oil were lost. "The loss on the Allegheny river," writes a correspondent, "is estimated at 400,000 or 500,000 gallons." The scene is graphically described in the columns of the Philadelphia Coal Oil Circular of December 13: "The boats grounding in great numbers; the larger overriding, crushing, and swamping the smaller craft, and breaking each other up. In the Friday's freshet twenty ill-secured boats at the upper wells broke loose when the water was first let off, and came down broadside, making a clean sweep of the creek, tearing away from the shores all the boats that lay successively below them, in spite of the frantic efforts of their owners. Oily ropes in oily hands were of no avail for snubbing round oily posts; everything went with a run, or rather with a slide, and for once, at least, the creek deserved its name. Boatmen, standing on oily thwarts and gunwales, and handling oily poles, were capsized into the water, and came out dripping with oil. One reporter counted fifty-six considerable wrecks between the Tar farm and Oil creek bridge. Boats were forced up to their full lengths out of the water upon the McClintock bridge pier, like floes of ice; three hundred barrels, staved and whole, floated from one of them alone. The new railroad will prevent such tragico-comic scenes from happening in future."

But far more fearful scenes than these by water have occurred on shore. More than once, in spite of all precaution, a spouting well has taken fire, and roared and burned like a volcano. Then pump works, engine-houses, stores and boats, the soil, the stream, and the river into which it pours its flame, spread their common conflagration over day and night. In the autumn of 1861 a well about three miles up Oil creek was lit by a cigar, while thirty or forty people were standing around it, of whom fifteen were killed instantly by the explosion and thirteen severely injured. A column of fire, with its head rising and falling from thirty to fifty feet, continued to burn.

The Little & Merrick well was one hundred and fifty feet deep at first, but in the spring of 1861 was deepened, without considerable increase of oil, until half-past six o'clock in the afternoon of April 17, when, from a depth of three hundred and thirty feet, a stream of oil and gas, mixed with a very little water, four inches in diameter, rushed up with such violence that its spray reached far beyond the top of the derrick. The air became an atmosphere of gas. The sickened hands forsook their boring tools and fled, leaving the oil to waste itself, like a cataract, into the creek. The engine firemen put their fires out. Soon a great crowd collected from the older works, and closely surrounded the new jet, when, suddenly, two simultaneous flashes, and a report like the rolling fire of a platoon of musketry, as it seemed to those at hand, but like two separate cannon shots to those who felt the concussions three miles distant, and to those that heard them seven and eight miles off, inaugurated a general conflagration. A scene of indescribable terror and confusion ensued. Yet all escaped but half a dozen, who were burned to charcoal where they stood; many others died, however, of their wounds, and numbers more were scarred for life. Four wells lost everything, including 500 barrels of oil on hand, and other property was destroyed elsewhere. In the dead of night there-

stood the fountain of flame, a jet of pure oil, not subsiding and returning to its work, but a ceaseless, unintermittent rush, like the steady blowing off of a steam boiler, and more than a hundred feet in height, rolling clouds of black and massive smoke up over the tops of the surrounding hills with a ceaseless, surf-like roar.

In the autumn of 1862 the tanks of the Filkins well caught fire, and the space burned over soon embraced from eighteen to twenty acres, on which one hundred and fifty oil tanks, full of a three months' supply, were standing close together, intermingled with engine-houses, offices, &c. Seven flowing and three pumping wells, with thirty thousand barrels of oil, took fire in quick succession. The flames ran up the trees of the maple grove, and the valley was black with smoke that stifled the heroic men who fought the flames. Men stood bravely on tanks of oil as dangerous as so many powder magazines. Oil creek, of course, took fire, and increased the grandeur of the scene. There were no explosions during the whole conflagration; crude oil is not explosive.

Returning to the general history of the oil regions, which we left for a moment to describe their biographical details, the mania for oil-well boring was not long confined to Oil Creek valley, but soon took possession of the main valley of the Alleghany from Franklin nearly up to Warren, and the lateral valleys of its tributaries, Two-mile run and French creek. It then spread southward, and began a similar history on Slippery Rock creek and Beaver and Mahoning rivers. Up the latter valley it spread into Ohio, and established wells in Trumbull county on some of the highest ground along the northwest edge of the coal measures in that State. The first borings, in the spring of 1860, were those of Mecca, twenty-one miles southwest of Erie. By the next November between six and seven hundred wells had been already sunk in one small district, and twenty-five steam-pumping engines were at work. This was even a greater increase than in the north Pennsylvania district, where the following is given in the Philadelphia Coal Oil Circular for June 7, 1862, as the state of things at that date:

Number of coal-oil wells now flowing	75
Number that formerly flowed, but now pumped	62
Number commenced or sunk, but not yet at work	358
Total	495

Total number of refiners, 25; amount of daily flow of oil, 6,717 barrels; amount at date on hand, 92,450 barrels; amount already shipped, about 1,000,000 barrels; valued at about $1,092,060 on the ground. Average cost of a well, $1,000; of all the wells, $495,000; machinery, &c., $500 to $7,000; of all the wells, $500,000.

But the oil region extended much further north. A citizen of Cuba, Alleghany county, New York, writes, under date of January 3, 1861: "Our village to-day is in a blaze of excitement, consequent upon the discovery of oil in large quantities in this immediate vicinity." An old mud hole, twenty feet across and ten feet deep, exists at the foot of the hill on the west side of the village, always covered with oil, famous for curing sprains and bruises. It is included in an Indian reservation one mile square, and has been described in the history of Sullivan's campaign. Governor Seymour, Judge Chamberlain, and others took possession of the reservation a few years ago, and have carried on lawsuits with the Indian claimants ever since; but in 1860 Alden, Bradley & Co. leased it of all parties, and began to drive a pipe down into the bog. At thirty feet the oil began to spout at the rate of a barrel an hour; other wells soon followed. Thus one oil field after another was opened and occupied in the United States along the western borders of the great coal field.

Meanwhile the western Canadians were not idle. The existence of bitumen in the coniferous limestone formation of the peninsula had been reported to the chief of the geological survey of the province by Mr. Murray, the western assistant geologist, as early as 1844, and the oil springs of the valleys of the Thames river and Bear creek are to be seen described in the reports of progress of 1850 and 1851. In 1853 the process of Mr. Young, of Glasgow, brought these Enniskillen county bitumen springs into wide repute, and in 1857 Mr. William M. Williams, of Hamilton, quitted the distillation of the solid bitumen, to undertake deep borings, in the hope of reaching its mother oil in larger quantities. Although in far lower formation than those from which the United States oil proceeds, he was entirely successful, and was followed by a crowd of adventurers, who sank nearly a hundred wells in Black and Bear Creek valleys before the visit of Mr. T. Sterry Hunt, in December, 1860. By his report we learn that from the small proportion of this number that did produce available quantities there had, nevertheless, been obtained at least 300,000 gallons. Since then others have been finished. In August, 1862, there were three hundred, and three new and productive wells were reported in November following. Even at Gaspé, near the mouth of the St. Lawrence, where Sir William Gogan describes petroleum springs long ago, companies began to be formed in 1861 to bore for oil.

In Virginia wells are in operation in Ritchie and Wirt counties.

4. THE THEORY OF THE ORIGIN OF COAL OIL.

It is probable that all instances of solid bitumen found on or beneath the surface of the earth have resulted from the hardening of drops or reservoirs of liquid coal oil. The lumps and crystals of graphite found in the oldest rocks, like the lumps of amber found in the newest, were doubtless oily substances involved by sand and mud. Flakes of anthracite are found in the centre of rock crystal. Gelatinous animals and fucous plants abounded in those ancient seas, and ought to have provided, by their death, plenty of animal and vegetable hydrocarbon for the mineral. The old red sandstones, like more modern formations, present us, for our cabinets, innumerable flattened fish, converted into bitumen; some in so perfect a state that every scale can be counted, and every sculptured line upon them submitted separately to the microscope; others an undistinguishable mass or daub of tar. Some rocks have been so thoroughly charged with animal dead matter that they emit a fetid odor whenever struck, and are technically known as stinkstones. The bituminous limestones and shales of many different geological ages are so many reservoirs of animal and vegetable oil, produced by the death and slow decomposition of successive floral and faunal creations, perhaps principally coralline. The fossiliferous black shales of the central belt of the State of New York underlie Lake Erie, cross Ohio and Kentucky into Tennessee, and return through Indiana and form the beds of Lakes Michigan and Huron. In middle Kentucky the faces of the rocks are smeared and streaked with oil, fried out of them by the sun, so that the surfaces are blackened as if with tar.

Up to the horizon of these black slates, ascending in the column of deposits, gelatinous sea organisms, both animal and vegetable, seem to have constituted the principal, if not the sole, apparatus for generating petroleum. But Dawson has lately discovered in the sandstones over them a true angiospermous exogenous tree, not much, if any, lower in the scale of development than those of which our forests are composed. Coniferous trees began also to abound, and coal beds to be deposited in groups. Thence the higher we ascend towards and through the second and the third or great coal measures, the more abundant became the vestiges of fresh water and land vegetation, until in the tree stumps of the coal beds of Nova Scotia we find small land animals. The mosses and ferns, the rushes and reeds, minute and gigantic, of which the coal

beds came, suggest the vegetable origin of coal oil. For it is near or between the three systems of coal measures which succeed each other in ascending from the top of the upper silurian to the coal measures proper that the amazing discoveries of subterranean reservoirs of oil had taken place. It is impossible to suppress the suspicion that petroleum is a product of the slow decomposition of vegetable tissue.

But the oil wells are not sunk in coal measures, but through them at the edge of the great coal area. The oil is never found in coal beds; nor have the subterranean reservoirs of oil apparently any connexion with coal beds, nor even with coal slates, or bituminous shales or pyroschists, as they are called. Black slate, cannel, fat coal, like lignite, peat and living wood, will yield the oils and gases by distillation, but the geological distinction must be carefully preserved between the free petroleum of the rocks and wells and the distilled petroleum of the old oil works.

The connexion of the oil regions with the coal basins of western Pennsylvania and Virginia, eastern Ohio and Kentucky, is, in good measure, a geographical deception.* The Oil creek rocks, dipping southward, pass 500 or 600 feet below the coal measures. The nearest coal bed to the more northern springs occurs on the highest hill-tops, many miles away. The hills in the vicinity of some of the wells are capped by the conglomerate base of the coal measures at least a hundred feet thick. The shales and sandstones of the valley belong to formations X, IX, and VIII descending, called by the New York geologist the Catskill, Chemung, and Portage groups, extending over all the southern counties of western New York. The southern dip carries down these oil-bearing rocks, and the wells must deepen in the same direction. Mr. Ridgeway reports (July 10, 1862) the lowest oil-bearing sand rock, capping the hills near Waterford, on Le Bœuff creek, and the same sandstones appear on Big French creek, full of plant remains.

The following wells show the dip in a well-marked manner: The Phillipps well, on Oil creek, is 460 feet; the Brawley well, at the mouth of Cherry run, 503 feet; the Cornwall well, 530 feet; the Avery well, over 700 feet; and at Titusville he estimates the proper depth at 1,000 or 1,200 feet.

In the Mahoning coal oil region in western Pennsylvania and eastern Ohio, near the line, the three oil-bearing sand rock strata are beneath the lowest coal bed. The "Continental" boring at Edenburg, in Lawrence county, penetrated, in descending order, the following formations before it struck the oil: First, the superficial drift, 80 feet thick. Second, sandstones and shales, 200 feet thick, the bottom layers of which consisted of fetid black shales, from which coal gas blew off with violence. Third, the first white sandstone, 50 feet thick, arranged in three strata, a softer middle between harder upper and lower formations; the whole mass said to be thin, going east, and holding abundance of gas in its crevices. Fourth, shales and slates, 45 feet thick, charged with oil and gas. Fifth, the second white sandstone, 75 feet thick—softer, coarser, and tougher, or more difficult to bore through than the first, and full of gas; after passing through which they struck the great oil stratum, 448 feet from the surface. Crawford's boring, not far off, went down 580 feet, through another shaley formation, and struck oil, supposed to come up through a crevice from the third white sand rock.

That there is an intimate connexion between the character of these sand formations and the character of the oil which issues from them is indubitable. The rule among the miners is, as stated by Mr. Clark in the "Proceedings of the American Philosophical Society," (June, 1862, page 57,) that the harder

* In the report of a geological reconnoissance of Indiana, 1859, 1860, under D. D. Owen, State geologist, and published in 1862, Professor Lesquereux expressed the opinion that the mineral oil of the borders of the coal field comes from the lowest great bed of the coal measures, I. B., (page 285.) The opinion of such an authority is to be carefully considered.

the rock may be to drill, the lighter in color, purer in quality, and smaller in quantity, will be the oil obtained therefrom; and the softer the rock, the darker and more abundant the oil.

The chemist of the Canada survey, Mr. Hunt, insists strenuously "upon the distinction between lignitic and bituminous rocks, inasmuch as some have been disposed" he says, "to regard the former as the source of the bitumen found in nature, which they conceive to have originated from a slow distillation. The result of a careful examination of the question has, however, led us to the conclusion that the formation of the one excludes more or less completely that of the other, and that bitumen has been generated under conditions different from those which have transformed organic matters into coal and lignite; and probably, in deep-water deposits, from which atmospheric oxygen was excluded."

Mr. Hunt instances in support of this view, the fact that the highly inflammable pyroschists or black slates of the Utica and Hamilton groups contain no soluble bitumen, and that the Trenton and coniferous limestones at the base of the silurian system are impregnated with petroleum, and give rise to petroleum springs, although no fossil land plant has been found in them. The fact that a considerable portion of the tissues of the lower marine animals is destitute of nitrogen, and very similar in chemical composition to the woody fibre of plants, forms another link in the chain of reasoning on this distinction between bituminous and lignitic rocks. The black slates, and even the coal beds are, in fact, layers of mud, charged slightly or to excess with lignitic matter, peat, or humus, part of which has assumed the form of glance coal and part the form of mineral charcoal, but almost none of which is soluble in benzole or sulphuret of carbon; whereas these liquids easily dissolve out the ready-formed bitumen from the rocks which may contain them. But whenever a coal bed became a repository of dead fish, like the eight-foot coal at the mouth of Yellow creek, at the bend of the Ohio, or as in the case of the two-foot stratum of phosphatic iron-ore deposited between the two benches of the Deep River coal-bed, at Egypt, in North Carolina—how different an aspect the mineral then wears, glossy with soluble bitumen!

Mr. Hunt argues with much force that the mere fact that intermediate strata, porous enough to absorb all the floating bitumen in their vicinity, are nevertheless destitute of any, is enough to prove that the accumulations of oil now furnishing the world with light, never came from the sub-volcanic distillations of the beds of coal in their neighborhood, but that the mineral has been generated by the transformation of organic matter in the strata where it is. Mr. Wall has shown that the asphalt of Trinidad and Venezuela (belonging however to a much later—upper miocene or lower pliocene—tertiary age) occurs in limestones, sandstones, and shales, associated with beds of lignite or fossil wood, and is confined to particular strata which were originally shales containing vegetable remains which have undergone "a special mineralization, producing a bituminous matter instead of coal or lignite, and not attributable to heat, nor of the nature of a distillation, but due to chemical reaction at the ordinary temperature and under the normal conditions of climate." He describes, also, wood partially converted into bitumen, when removed by solution, woody fibre remains.—(Proc. Geol. Soc., Lond., May 1860. Hunt.)

The theory of the genesis of coal oil is, however, far from being cleared up by such facts. It is true that the oil is not found in immediate contact with coal beds made of land or fresh-water plants; but on the other hand, coal oil regions are geographically connected with coal-bed regions, whether of devonian, carboniferous, oolitic, or tertiary age. Coal beds are said to underlie the Rangoon oil wells. Tertiary lignites abound in Trinidad, Venezuela, Lombardy, and middle Asia. The lower devonian horizon of the Canada black-slate oil region yields coal beds in Pennsylvania. The structural difficulties attending the solution of the problem remain.

Fissures are filled with oil, and gas, and salt water, and different wells strike them at different depths. The oil-bearing sand rocks seem charged from top to bottom with gas and blow off from every fissure as it is passed through by the auger. Whence comes this gas, if not by subterranean distillation? It is impossible to postulate the gas first and the oil afterwards; for that order would require the generation of pressure sufficient afterwards, and the oil would be in the condition of a mechanically explosible fluid. The gas must be a subsequent expansion of the oil, as it is in the case of coal-mine fire-damp. Whence, then, comes the oil, and why has it collected in reservoirs? How are such reservoirs preserved, and what is their extent? It is easy, after these questions have been answered, to describe the mechanical propulsion of the oil to the surface, partly by gravity and partly by the pressure of the gas it has itself generated, through natural fissures producing natural oil springs, or through artificial auger holes. The intermittent action of most of the flowing and spouting wells is like that of the Iceland geysers, where steam is the motive power. The oil men of the Mahoning valley say that more gas is blown off in winter than in summer.

At the Edenburg well, above referred to, the blast of gas is sometimes violent enough to stop the pumping engine for half an hour at a time. Mr. Clark reports a periodicity or daily maximum in the paroxysms. He noticed for several weeks that they recurred with singular regularity a few minutes after eight o'clock in the evening, when the engine was forced to stop for twenty minutes or half an hour.

In the almost unchanged horizontal posture of the western coal measures no considerable fracturing or fissuring took place. Faults of all kinds are uncommon and very small when they exist at all. The rise of the stratification from the Alleghany river towards Lake Erie is a fraction of one degree. The original contents of the rocks have therefore been preserved. Not so with the anthracite basins on the southeastern side of the great coal area. Crushed and upturned and overturned, contorted and fractured in every part, this part of the earth's crust has been dried and hardened, and exposed to chemical action from the superincumbent drainage waters, until its various formations (the coal beds included in the number) have been metamorphosed and partially recrystallized. The oils which they contained have been lost by dissolution and evaporation. The bituminous coals have become anthracites, and the last oil spring on the headwaters of the Lehigh, the Schuylkill, the Juniata, the Potomac, or the New river, ceased to flow many millions of years ago. In the west, on the contrary, in equally ancient, nay, in identically the same rocks, the petroleum still remains, having had no outlet; always hermetically sealed and under pressure. It remains partly condensed in coal beds and black shales, partly distributed through the sand rocks and limestones, and partly filling up the joints which the shrinking of ages has produced. Possibly a small portion of it may be held in caverns through the more soluble limestone strata. Especially important are the water-bearing horizons.

The vertical cleavage planes and few down-throw fissures which exist play but a subordinate role to these. Rain-waters percolate from every hill surface and valley bed, sidewise and downwards, leeching every permeable stratum that will give up its salt and oily contents. Along the outcrops of every coal bed issue innumerable springs of painted water. At the base of every great sand rock, and on the top of the clayey deposits next below it, collect the mixed proceeds of the drainage in a standing sheet of oily brine. Capillary attraction and hydrostatic pressure perpetually re-enforce the reservoir. The weight of rock on top and the pressure of disengaged oil-gas sends its filaments forward and upward by every secret crack to the surface again, holding it in every part ready for an explosive rush into the air when an artificial outlet is provided. If there be no fissure in the locality, the oil wells descend to the sheet of water at about the same depth. Where fissures intercept them they are of various

depths and fortune, for a well may pass a fissure where its walls are polished and tight together. A well may also pass the water sheet where some change in the porosity of the rocks above and below has taken place to oppose a like obstruction. In some parts of the western coal-field the dip is as high as five degrees, and the basins from five to ten miles wide. Sharp flexures make local dips of thirty degrees or more, and a central sub-anticlinal is sure to subdivide the basin. In the secondary basins thus formed the wells are more perfectly artesian as to the salt water; but it is upon the subdividing anticlinals that the gas and oil collect. In such regions it is asserted that *all the blowing* and many of the spouting wells are ranged along the summits of such anticlinals. In the case of some of the old gas-blowing salt-wells, their actions demonstrate that they have been bored past one gas-bearing stratum to another deeper salt water stratum; for when the water is allowed to rise in the auger hole, by stopping the pumps awhile, then the gas and oil no longer come up, the brine stopping their issue. In the case of neighboring wells of different depths striking a slanting fissure, the one which strikes it highest up will deliver gas; another, striking it lower down, will deliver oil; a third, striking it still lower down, will deliver nothing but salt water.

The compressibility of coal-oil gas is one of its most dangerous qualities, increasing indefinitely the dangers of those explosions which annually cost so many valuable lives. Confined in the walls of the gangways and rooms, it issues from innumerable cells or pockets, the larger of which are called "blowers;" sometimes with the noise of heavy rain; sometimes with small reports. It collects among the timbers of the roof, in the upper galleries of the mine, in deserted portions of the colliery, and especially in those accumulations of refuse coal and slate, called "gob," or "goaf," with which the miners pillar up the superincumbent rocks. These acres of worked-out and filled-up galleries become vast reservoirs of fire-damp. The gas collects especially over the anticlinal rolls. From these great powder magazines, solicited by the least diminution of barometric pressure in the atmosphere, the gas rushes out to fill the working rooms. Long experience has shown that a falling barometer and explosions in coal mines always go together. But the mischief is accumulative. The vacuum produced by the first explosion is a new provocation to the world of back gas to leave its hiding places, come forward afresh, and produce another, and again another, until the proportion of air to gas becomes too small to make an explosive mixture; so that, like the stroke of lightning, the coal mine explosion is not a unit, but a series, cause and effect reciprocally acting to produce the last result.

Among the most curious exhibitions of superior lightness of petroleum to other minerals with which it is found, and of the nice train of reasoning dependent thereon, is the observation of Mr. Vanuxem that the film of black bitumen found in the cavities of the calciferous sand rock of New York, with crystals of bitter spar and quartz, occur on the upper side of the crystals, on the mother liquor of which they once floated as pellicles of oil; and, as the crystal hardened and grew, it moulded the oxydated oil to a sheet of bitumen, brittle, very pulverulent, of a shiny black, yielding little ash, and 11½ per cent. of principally) water. The same mamillary surface, arguing original fluidity, characterizes the specimens obtained by the Canadian mineralogist from the Quebec group—filling cavities in its limestones, sandstones, and even in the accompanying trap dykes; readily crumbling to a black powder, and, when highly heated, giving off an abundance of strong-smelling, inflammable gas, condensing to a tarry oil, and leaving 80 per cent. of a black residue, which, when heated slowly, burns away, leaving only a trace of ash. The same kind of mineral found at the Acton copper mine is harder, less friable, and more like anthracite.—(Hunt.) The petroleum which fills cavities in the Montmorencie rocks is still unhardened. It flows in drops from a fossil coral of the Birdseye

limestone there; and at Pakenham it fills the cast moulds of large orthoceratites in the Trenton limestone to such an extent that about a pint has been poured out of one. It is perhaps from these lower silurian fossil coralline limestones that the oil makes its way to the surface through the overlying Loraine shales to form the Guilderland oil spring near Albany, according to Beck, through the Utica slate on the Great Manitoulin island, and through the red Medina shales at Albion mills, near Hamilton, according to Mr. Murray.—(Hunt.)

The next great limestone in the ascending series is the Niagara, and Eaton early made known the oozing of petroleum from its fossil casts. Hall describes it in Monroe county as a granular crystalline dolomite, including small laminæ of bitumen, which give it a resinous lustre. Bitumen sometimes flows like tar from the lime-kiln. The coniferous limestone, next above the Niagara, has the cells of its fossil corals filled with petroleum, the remains of the gelatinous coral animal which inhabited them. Mr. Murray drew attention to this fact in 1844, and cited the Gravelly bay quarries in Wainfleet, Western Canada, as examples.—(Report of 1846.)

The oil springs of Enniskillen, as well as the lake of solid bitumen in the same township, half an acre in extent and two feet thick, no doubt have their deep-seated sources not in the black shales of the region, but in the coniferous limestone underneath. These black shales belong to the base of the Portage and Chemung group. The wells sunk in them soon strike the argillaceous shales and limestones of the Hamilton group, and go through them toward the coniferous limestone, specimens of which yielded to Hunt's analysis from 7.4 to 12.8 per cent. of bitumen, fusible and readily soluble in benzole.

In the blackish Marcellus shales, at the base of the Hamilton group, are found septaria or nodular concretions containing petroleum. The same phenomenon recurs at the top of the Hamilton group. Still higher up, the Portage and Chemung sandstones (formation viii,) are often bituminous to the smell, and contain petroleum in cavities, or hardened into solid seams. A calcareous sand rock in Chatauqua county contains more than 2 per cent. of bituminous matter. These are the rocks around the famous oil springs of the Seneca Indians. It is only necessary to ascend the series of these devonian sandstones to their upper part among the rocks of the Catskill group, or just beneath them, to find oneself in the oil regions of northern Pennsylvania and Ohio, described by Dr. Newberry and others, and sufficiently treated of in the foregoing pages.

There only remains to be noticed that anomalous deposit of the Albert coal in New Brunswick, made famous by long litigation and the discussion of geologists, described by Professor Dawson in his Acadian Geology, and called by Dr. Wetherill, of Philadelphia, Melan-asphalt.—(Trans. Amer. Phil. Soc., July 16, 1852.)

Its position has been misinterpreted by several observers, who have reported it a volcanic injection of bitumen into a fissure of the earth, many feet in width, by the force of which large pieces of the wall rock have been torn off and carried forward in the mass. It seems, however, pretty well made out, that it was originally a horizontal bed or lake of petroleum, hardened and covered up by sand and clay deposits of carboniferous age, and afterwards upturned, bent over and fractured so as to assume its present posture. It is not properly a coal bed, therefore, but a mass of hardened coil oil, which can be, and, in fact, has been, mined like a coal bed, and the product used wholly for making gas. Dr. Wetherill's analysis gives: Coke, 44.35; volatile matter, 55.55; ash, 0.10. Specimens of Cuban asphalt analyzed at the same time gave: Coke, 32.00; volatile matter, 67.60; ash, 0.40; or, subtracting the ash and uniting the oxygen and nitrogen: Carbon, 86.123; hydrogen, 8.971; oxygen and hydrogen, 4.906 = $C^{68} H^{42} O N$. Like Cuban and Egyptian asphalt, this Albertine (as it is commonly called) is highly electrified by friction, which coal is not.

MARBLES OF RUTLAND COUNTY, VERMONT.

BY S. M. DORR, OF RUTLAND, VERMONT.

THE village of West Rutland, near which the largest and most valuable quarries of marble in Rutland county are located, is a small hamlet in the west parish of Rutland, eighty-one miles north of Troy, New York. It is the centre of a fine farming community distinguished by its thrift and wealth. It is approached from Troy, New York, by the Rutland and Washington railroad, through Salem, New York, and Castleton; by the Troy and Boston, and the Western Vermont railroad, through Bennington, Manchester, and Rutland; by the Rensselaer and Saratoga railroad, through Saratoga Springs and Whitehall, New York; and by the Rutland and Burlington railroad, from Montreal and Burlington on the north, and from Boston and Bellows Falls on the east.

This article will be confined to the marbles of Rutland county. There are other quarries of marble in Vermont, particularly in the counties of Bennington and Addison. At Middlebury, in the last named county, the first American marble offered in the market was quarried. In that town the main principle now in use in sawing marble was invented and applied.*

It is well known that all that peculiar formation of limestone known as "*marble*," which is produced in the United States, exists in the mountain range which can be traced from the vicinity of the city of New York north, through the eastern States to the line of the British provinces. To those who have examined the formation at different localities in this range, it is further known that as we go *north* the grain and texture of the marble increase in fineness and beauty. It is also an established fact that the finer the formation the greater is the liability to *unsoundness*. The marbles of Rutland county appear to have been developed in that limit of northern latitude which has produced the *finest marble* with the greatest degree of perfection and soundness. Hence, as we go further north from this point, we find the *fineness* of formation to increase; but, at the same time, the quarries which have been opened show the marble to be so checked and "cut," as it is called in the trade, that the working of it has proved unprofitable.

At the distance of half a mile from the depot in West Rutland, on the north side of the railroad, is a range of hills, which, in the vicinity of the quarries, rises, about, to the height of two hundred feet above the bottom-lands below. Back of this, and extending east towards the base of the Green Mountain range, is a succession of other and higher ridges. On the western slope of the ridge first referred to and near its base crops out the "Rutland Marble."

The first opening that we reach is the quarry of Messrs. Sheldons & Slason. The strike of the bed is N. 10° E., and the average dip 45° E. Marble has been taken from this quarry to the depth of 150 feet. On their premises, and near the ledge or quarry, they have a large steam mill for sawing the blocks of marble into suitable sizes and shapes for market. Their mill has twenty "gangs" of saws. Their blocks are hoisted from the ledge by the same power that moves the machinery of the mill. In quarrying, sawing, and sending the marble forward to market, they usually employ two hundred men.

* By Doctor Eben W. Judd, a gentleman long engaged in the quarrying and manufacture of marble.

North of Messrs. Sheldons & Slason, and about forty rods distant, is the quarry of Messrs. Allen & Adams. The strike of the beds is nearly north and south, and the dip 55° E. Their blocks of marble are placed on the cars of the Rutland and Washington railroad, (a side-track from said road running the whole length of all the West Rutland quarries,) whence it is transported to their mills at Fairhaven, and there sawed into such shapes and sizes as their trade demands. Their mill has twelve "gangs" of saws, and they employ, in quarrying and sawing, one hundred men.

Connected with the opening of Allen & Adams, on the north, is the quarry lately known as that of the "Rutland Marble Company." This property is now owned and worked by H. H. Baxter, esq. The beds are the same as in the opening of Allen & Adams. The dip of the layers at the north end of the opening is 34° E., and at the south end, or at the junction with Allen & Adams, the dip is 44° E. Mr. Baxter employs two hundred men. Quite a number of blocks from this quarry are sold to the marble trade of Boston, New York, and other cities of the United States and of the Canadas; but by far the larger portion is transported by the cars to the marble-mills of William Y. Ripley, esq., and of Messrs. Clement & Son, at Centre Rutland. Both these mills are on Otter creek, the former having fourteen and the latter twelve "gangs" of saws. Mr. Ripley is a pioneer in the marble business in this county, having originally owned one-half of the Baxter quarry in connexion with William F. Barnes, esq., and having erected the first mill of any pretensions for sawing marble from the Rutland beds. About fifty men are employed in these two mills.

Going north from the Baxter quarry, we next come to the opening of Sherman, Adams & Langdon. The dip of the marble in this bed is 25° E., and is transported in the block, by railway, to their mills in Castleton and Hydeville, where it is sawed and prepared for market. They employ seventy-five men and operate sixteen "gangs" of saws.

North of this opening, Messrs. Sheldons & Slason have another quarry, the beds of which are somewhat curved, and have a strike N. 10° W., with a dip of from 50° to 60° E. The working statistics of this quarry are included in the account of their first quarry, already given.

The most northern opening yet made is that lately incorporated under the name of the "Vermont Marble Company." The strike of the bed in this is N. 15° W., and the dip 70° to 85° E. A steam mill with six "gangs" of saws has been erected on the premises. Within the past year the property has changed hands and has been but little in operation.

In the north part of the town of Rutland, on the line of the Rutland and Burlington railroad, six miles north of the quarries already described, the "Sutherland's Falls" quarry is situated. The character of the marble in this quarry does not correspond in color or texture with the marble known in the trade as "Rutland Marble." No white marble is taken from this quarry. The strike of the bed is different, being both east and west, and at an angle varying from 20° to 60°. The company have two small mills in operation on their premises, and have the advantage of one of the finest natural water-powers in the State. They employ forty men.

On the same side of the railroad, three miles southwest of the village of Brandon, is the quarry of Mr. E. D. Selden. Some very fine marble is taken from this quarry and sawed at his mill. He employs from forty to fifty men.

The different quarries to which I have referred comprise all the openings at present worked within the limits of Rutland county, and are, in fact, *the* quarries from which most of the American marble used in the United States and the British American provinces is taken.

I have described *six* different quarries or openings at West Rutland. They all lie upon the same slope or side hill, and from the most southern to the most

northern opening the distance is not more than one mile. From these to the quarry at Sutherland's Falls the distance is six miles, and from the latter quarry, north to that of Brandon, nine miles. Thus, within a distance of fifteen miles, on a northern and southern line, all the marble of Rutland county is found.

The marble in the quarries at West Rutland is usually overlaid by pure limestone rock, and is reached by blasting into the limestone and removing it from the surface of the ledge. This is carried on until a sufficient quantity is uncovered for a year's business.

The reader will bear in mind that the marble in the quarries, especially at West Rutland, runs down *into* the hill on an average angle of about 45°. Also, that the ledges are made up of different layers of marble, one above another, lying together like the leaves of a book, or rather like a number of books of different thickness, one above another, on an angle corresponding with the dip of the marble in the earth. The layers vary in thickness from *two* to *nine* feet.

The limestone having been removed, the quarrying of blocks is commenced. Suppose that the blocks to be taken out are required to be *six* feet in *length*. A strip from the upper layer in the ledge is lined off, six feet in *width*, and any desired length, and all along the line thus drawn men with "churn-drills" of steel, ground to an edge and made somewhat like a crow-bar, take their position for work at distances apart convenient for working. With these "churn-drills" a channel is cut upon this line at right angles with the "lay" of the marble, and to a depth required for the thickness of the block. This *depth* or *thickness* usually reaches what is called by quarrymen a "*raising bed*." This is always a *seam*, or a point in the layers where the marble is known to divide or split easily. After the channel is cut, the same drill is used for making circular holes underneath the marble, on the line of the "raising bed," the whole length of the channel above. These holes are made at distances apart and to depths depending altogether upon the difficulty of separating the block *above* from its bed *below*. These drill-holes are from one and a half to two inches in diameter. When all is ready for raising, two pieces of half round iron are inserted in each drill-hole, and between them are inserted iron wedges in such a way that when they are driven in the pressure will be *upward*. The drill-holes on the whole length are thus provided with keys and wedges, and the workmen commence driving in the wedges evenly and gradually, so that the upward pressure along the whole length of the channelled block will be as nearly equal as possible. These are gradually driven in, until the pressure from below is so great that a seam is opened, and the whole block is released from its bed. We have now a block, say, forty feet in *length*, and six feet in *width*. This is too long to be used for any purpose, and is so heavy that no machinery can handle it. The next process is to reduce this great mass to sizes which can be handled by the ordinary facilities for this purpose, and which correspond with the dimensions of the "mill gangs," under which they must be placed for sawing. This is done by the process of again drilling and wedging. If blocks are wanted six feet long, they are broken off crosswise; if longer than six feet, they are broken the length of the main strip, and then divided the other way.

A book of any size will well represent the general form of a block of marble taken from the quarry and ready for sawing. The grain of the marble may be said to correspond with the leaves of the book, and in sawing the marble into slabs, the block will be so placed under the saws that they will go down between, and not across, the grain of the marble. It often occurs that in the same block there is both *white* and *colored* marble. Color usually follows the grain, and hence in sawing a block the color will be followed by the saws,

because it indicates the grain. If no color appears in the block, the grain is then indicated by the bed from which it was raised.

Having described the operation of taking one block from the quarry, it will, of course, be understood that the labors of the year are but a repetition of this process.

The aggregate thickness of the different layers of marble varies in each ledge. Each owner would doubtless claim for his quarry some superiority over others, either in soundness or in quality. The value of an opening depends, first, upon the comparative amount of white marble; next, upon its soundness; and, lastly, upon the quantity of earth and rock necessary to be removed before good marble is reached. It is not an unusual thing for a quarryman to spend $60,000 in uncovering and preparing a quarry before finding blocks good enough to pay the expenses of sawing.

In the regular order of the marble business, the next operation to be described is that of sawing the blocks into slabs of various thicknesses. They are placed in the mill, under what is called a "gang of saws." This "gang" is a frame-work strongly made of timbers from six to eight inches square, the dimensions of which vary from four to five feet in width, and from eight to twelve feet in length. Across either end are "head blocks," usually of iron, in which are inserted "iron dogs," on one side of which is a "claw," which is inserted through a hole in the end of the saw plate, punched for this purpose. Through the opposite end of each "dog" a key is inserted, by which the saw is strained to its proper tightness. The saws are nothing more than plates of soft iron, one-eighth of an inch thick, about three inches wide, and in length corresponding with the length of the "gang" between the "head blocks." The saws are kept in their proper relative positions to the sides of the "gang," and, of course, to the block of marble to be sawed, by means of wooden gauges, at such distances apart as the thickness of the slabs to be sawed require. The "gang" is suspended above the block by means of four chains or ropes fastened at each corner, and wound up on wooden rollers above.

It will be evident to the reader that the object of this is to allow the "gang" to drop in the track made for the saws as they work their way through the block below. The "gang" is kept in its place by upright posts, standing at either corner, and between which it moves. Pitmans are attached either to the sides, in which case there are two, or at the end of the "gang," in which case only one is used. These pitmans are attached to pulley shafts, and at every revolution they move the "gang" backward and forward above the block. Water is now allowed to run upon the block from above in small quantities, and sand is thrown upon it. The sawing is effected by the operation of the sand wearing the marble away as it is rolled and pressed under the smooth, thin plates of iron called saws. The least thickness that can be sawed from a block is about seven-eights of an inch. Any thickness above this can, of course, be sawed, limited only by the width of the "gang" and the size of the block. When the saws have gone down through the block, the whole "gang" and saws are elevated by means of ropes and pulleys above the block, and the slabs are now ready to be taken out and broken or sawed into such dimensions as are required. They can be tooled or channelled on the surface, and broken in straight lines when it is not over four inches in thickness. All slabs of greater thickness are sawed, as they cannot be relied upon to break in lines. Having been broken or sawed into such shapes and dimensions as is required, it is ready for sale. The value, at the quarry, of the marble thus manufactured varies with its quality and the uses to which it is to be applied. The best quality of statuary marble is worth $5 50 a cubic foot. The best quality in slabs, two inches thick, is worth ninety cents, superficial measure. The same quality, one inch thick, is worth sixty cents. Other qualities of both kinds of marble sell at prices considerably less.

To enable the reader to judge of the extent of the business in Rutland county marble, I have procured from the books of the Rutland and Washington Railroad Company and of the Rutland and Burlington Railroad Company the following statement of marble shipped on their cars during the year ending November 1, 1862:

	Pounds.
From the quarries in West Rutland, blocks	21, 446, 645
From the mills in West Rutland, sawed	4, 207, 309
From the mills in Centre Rutland, sawed	7, 599, 467
From the mills in Castleton, sawed	926, 688
From the quarries, Brandon, blocks	114, 900
From the mills, Brandon, sawed	526, 113
From the Sutherland's Falls	1, 341, 987

It should be remembered that the marble sawed in Centre Rutland and in Castleton is all quarried at West Rutland, and is transported on the cars before it is sawed, and should be omitted in the following calculation. If, therefore, we reduce the block marble to superficial measure, by rules recognized by those who are employed in this business, we have—

	Feet.
Block tonnage reduced to two-inch marble	715, 000
Add sawed in West Rutland, reduced to the same thickness	135, 720
Total from six quarries in West Rutland	850, 720
Add block and sawed marble quarried in Brandon, reduced as above	21, 248
Add block and sawed marble quarried at Sutherland's Falls	43, 290
Total production from Rutland county	915, 258

It would be a reasonable estimate to say that this marble is sold, delivered on the cars at the several mills, for fifty cents per foot. This estimate gives us, in round numbers, $458,000, as the annual value of the business in Rutland marble. This marble, in its unwrought state, finds its way into every nook and corner of the United States and of the British American provinces. Those who are conversant with the details of *finishing* this vast amount of the raw material unite with me in the estimate, that when appropriated to its various uses it will show a yearly business of the aggregate value of two millions of dollars. The uses to which Rutland marble is applied are various. In general terms they may be stated by saying that it is used for tile, mantel work, furniture tops, statuary purposes, gravestones, and monumental work, and also for building purposes. By far the largest quantity is used in erecting enduring remembrances to the dead. As generation after generation passes away, each in succession rears to the loved ones who have gone before a record that shall withstand the dissolving touch of time, and in ages to come shall mark the spot where, "earth to earth and ashes to ashes," the silent dead sleep on.

HEALTH OF FARMERS' FAMILIES.

BY DR. W. W. HALL, OF NEW YORK CITY.

The impression pervades all classes of society that the cultivation of the soil is the most healthful mode of life, and gives the highest promise of a peaceful, quiet, and happy old age. Dwellers amid brick and mortar, looking on from a distance, have visions in which it is a luxury to indulge, of independence, of comfort, of repose, and of overflowing abundance, as inseparable from a farm-house; and under the influence of these, with the bewitching and sweetly sad memories of blossoms and budding trees, of green pastures and waving meadows and birds of spring, of fishing and hunting, of shady woods and cool, clear waters dashing briskly over pebbled bottoms, they pine for the country with deep and abiding longings. It may, therefore, be practically useful to inquire as to the correctness of these views, whether they are not materially modified by incidental circumstances which do not necessarily exist, and if so, what may be the best remedy for their prevention or removal. To do this properly, we must look whole facts full in the face, and take our departure from what is, and not from what we may think ought to be.

In passing through a lunatic asylum the visitor is sometimes surprised to learn that the most numerous class of unfortunates are from the farm; yet in England, in 1860, but about one-fifth of the population was agricultural. Persons who have taken pains to inquire report that the number of farmers is much less than is generally supposed, in comparison with those engaged otherwise, in the mechanic arts, professional life, the army and navy, &c. The census of 1840 shows that for Eastern Pennsylvania there were eighty thousand farmers, and seventy-four thousand engaged in trade and commerce. While looking at a list of occupations,

The professions number	32
Farmers	60
Commerce	65
Mechanic arts	147

Adding to these the number who have "no occupation," the proportion of farmers to the whole will be considerably less than one farmer to four of all others.

Dr. Kirkbride, of the Pennsylvania Hospital for the Insane, in his report to the legislature, says one-seventh of the male patients had no regular occupation at the time of attack, while for 1850 the most numerous class were those who had been in some way engaged in agriculture, either as farmers, farmers' wives or daughters. This proportion is not invariable, for in 1862 the same gentleman reports that of 3,947 insane there were 297 farmers, 170 of their wives, and 95 of their daughters—a little less than one-seventh of the whole were from the farm. Of the 4,014 patients in the Central Lunatic Asylum of Ohio, as reported to the legislature for 1862, 1,108 were from the farm. The statistics of the insane in Massachusetts show that the largest number of cases were of farmers' wives.

Nor do farmers live the longest. Travellers and natural philosophers average a greater age. The clergyman, who devotes his life to study and late hours, who spends three-fourths of his existence in-doors, who does not average

two hours' daily exercise in twenty-four, who is compelled to an inactivity of body which would seem enough to undermine any constitution, to say nothing of the many depressing influences connected with his office, in listening to the troubled, in counselling the sick, and in waiting upon the dying and the dead—even he often survives the farmer, who rises with the lark to breathe the pure out-door air, whose undisturbed nights, whose supposed independence of the world tend to health, whose table is thought to be spread every day with the freshest butter from the dairy and the new-laid eggs, with pure, rich milk from the spring-house, all cool and sweet, vegetables just dug from the ground or pulled from the vine, and melons taken from the garden, berries from the bending bushes, and fruits, luscious, perfect, and ripe, from the orchard, within the hour; in short, a class of persons whose whole surroundings are universally believed to be the synonyms of quiet, plenty, and independence, and which would seem to be a full guarantee of a healthful and happy old age, does not attain it as often as some other classes whose habits and modes of life are not, other things being equal, as favorable to longevity. In the light of these statements it is proposed to inquire—

First. Why is the farmer more liable to insanity than the citizen? Second. Why does he not average a longer life?

Incessant thinking on any one subject tends to craze the brain, and it does unhinge the intellect of multitudes, as witness the fate of men of "one idea;" of inventors; of inveterate students of prophecy; of those who abandon themselves to thinking of the loved and lost; of the victims of remorse or mortified pride; or of those who feed on sharp-pointed memories. Learned physicians of all civilized countries agree that, in cases like these, it is best to divert the mind, by travel, to a new class of thoughts, to a greater variety of objects of contemplation. It is known that within a short time the attention of the French government has been officially drawn to the fact that one in ten of the young gentlemen who are educated for the army, in the mathematical department, becomes deranged; this is because the mind will not bear exclusive action on one subject. This is the key to the so frequent cases of insanity and suicide among farmers; their subjects of thought are too few; their life is a ruinous routine; there is a sameness and a tameness about it, a paucity of subjects for contemplation, most dangerous to mental integrity.

It is too much the case with our farming population that they have no breadth of view; they cannot sustain a conversation beyond a few comments on the weather, the crops, the markets, and the neighborhood news. And it is worthy of note that their remarks on these subjects are uniformly of the complaining and unhopeful kind, as if their occupation and their thoughts were on the same low and depressing level. This is because the mind is not used enough; is not waked up by a lively interest in a sufficient variety of subjects to promote a healthful tone.

The proper and the all-powerful remedy against the sad effects of a plodding routine existence is a higher standard of general intelligence and a livelier attention to what is too often derisively styled "book-farming." The highest form of human health is found in those who exercise the brain and the body in something like equal proportions. If the greater share of the nervous energies is sent out through the muscles, they will be largely, even preternaturally, developed; but then the brain languishes for want of its due amount of aliment, vigorous thought, while that same body, having been unduly worked, wears out before its time and prematurely decays. It is even better for the mind and body both, that if either has the larger share of exercise it should be the brain, for thereby the chances of longer life are increased, since statistics clearly show that, as a general rule, the most intellectual live the longest. Professor Pierce, of Cambridge, after having examined the subject closely in reference to the young gentlemen pursuing their studies at Harvard University, remarks,

as the result of his observations, that, "taking classes in the average, those are the first to die who are the dullest and most stupid, while, as a general rule, those who exercise their brains most constantly, thoroughly, and faithfully, are the longest lived."

The lamented President Felton was accustomed to urge upon the young gentlemen of his classes, with great earnestness, as a means of high health, that they should "use the mind;" use it actively, and on a variety of subjects, so as to avoid any dull routine.

It is an observed fact that many of those sent to penitentiaries for long terms, or for life, become idiotic; but that among the number there is seldom found one who had even small pretensions to a liberal education or to mental culture in any direction. The gifted and unfortunate Mary Queen of Scotts, after lingering eighteen years in prison, came forth to the block with that vigor of mind and clearness of intellect and composure of manner which bespoke a healthful brain. Multitudes of distinguished men have passed a large portion of their lives in prisons, yet maintained their mental integrity, and lived long enough afterwards to accomplish great deeds. Count Confalioneri, having rendered himself obnoxious to the Austrian government, was confined in a dungeon ten feet square for six years, with so dim a light that he could not distinguish the features of the solitary companion of his misfortunes; after which time he remained nine years longer, entirely alone. He writes of himself: "Only one event broke in upon my nine years' vacancy. One day—it must have been a year or two after my companion left me—my dungeon door was opened, and a voice, I knew not whence, uttered these words: 'By order of his Imperial Majesty, I intimate to you that one year ago your wife died.' Then the door was shut. I heard no more. They had but flung this great agony in upon me, and left me alone with it again." Without a book, without a companion, without any intelligence from the outer world, confined in a dark dungeon, living on the coarsest food, having those inward resources which a superior education gave, he fed upon them, and thus maintained both mental and bodily health; while the uninstructed farmer, who can feed on the fat of the land, who passes near three-fourths of his existence in the blessed sunlight, greedily drinking in the luscious out-door air in all its purity, with no restraints of bodily liberty, so abandons himself to the dull routine which comprises almost nothing but to work and eat and sleep, often finds in a less time than fifteen years that vigor of mind and health of body are both on the wane. But a better time is coming, through the influence of our glorious public school system, when it shall no longer be considered an all-sufficient qualification for a farmer that he have a vigorous frame and intelligence enough to skillfully wield an ax or turn a furrow or drive a team. Men are already beginning to perceive that encouragingly remunerative farming is the reward of those who have made themselves familiar with the analysis of soils, who have some knowledge of botany and vegetable chemistry, who have given some study to ascertain the surest way of obtaining the best seeds and the best breeds, and who have "method in their" book "madness," in the selection of cions and grafts and roots and plants. Such men not only make money by farming, but have a positive delight in their labor, and in waiting for results; for one of the sweetest sensations possible to the human mind is the development of useful practical facts as the result of trials and experiments. If the young farmer then begins life with a better literary education, and every farmhouse is regularly visited by some well conducted agricultural periodical, the mental horizon of the hard working tiller of the soil will soon become so extended that a demented farmer will become the rarest of sights. There is another item in reference to the farming population of this country, which certainly adds to the number of its lunatics: it is that grim specter DEBT, which is voluntarily set up in the households of three farmers out of four, whether in

the cabin of the thriftless squatter or in the mansion of the princely planter. It is generally a very grave mistake, in the hope of making money by the rise of land, to purchase more than can be conveniently paid for on the spot, or more than can be advantageously cultivated with the force at command. This demon of debt, with its "interest" eating out the farmer's substance ceaselessly and remorselessly, day and night, summer and winter, in sunshine and in shade, is in multitudes of cases a vain sacrifice to the Moloch of gain, a yawning maelstrom, pitiless and unappeasable; it eats out half the joys of many families by reason of the self-denials, the always losing "make-shifts," the working to disadvantage and consequent extra labor, with those anxieties and solicitudes which are necessarily imposed, and which, in their turn, induce irritation of mind, irascibility of temper, and that forgetfulness of those domestic amenities which many times convert a trouble into a pleasure and alleviate or take entirely away half the burdens of life. These acerbities of temper grow by what they feed upon, and seldom fail in the end to leave an evil impress on the character of those upon whom the disturbing consciousness of debt presses with the weight of the nether millstone, impelling too often to the razor, the river, or the halter; for it is not an unknown thing, by any means, that the hard working farmer becomes a suicide. To make this article more specifically practical, the attention of farmers' families is invited to the chief and direct causes of nine-tenths of the diseases which cloud their happiness, which interfere with their prosperity, and often largely add to discouraging expenditures of the means which it caused so much labor to acquire; and first to

EATING.

The stomach has two doors, one for the entrance of the food, on the left side, the other for its exit after it has been properly prepared for another process. As soon as the food is swallowed, it begins to go round and round the stomach, so as to facilitate dissolution, just as the melting of a number of small bits of ice is expedited by being stirred in a glass of water; the food, like the ice, dissolving from without, inwards, until all is a liquid mass.

When food is unnaturally detained in the stomach, it produces wind, eructations, fullness, acidity, or a feeling often described as a "weight," or "load," or "heavy." But nature is never cheated. Her regulations are never infringed with impunity; and although an indigestible article may be allowed to pass out of the stomach, it enters the bowels as an intruder, is an unwelcome stranger, the parts are unused to it, like a crumb of bread which has gone the wrong way by passing into the lungs, and nature sets up a violent coughing to eject the intruder. As to the bowels, another plan is taken, but the object is the same—a speedy riddance. As soon as this unwelcome thing touches the lining of the bowels nature becomes alarmed, and, as when a bit of sand is in the eye, she throws out water, as if with the intention of washing it out of the body; hence the sudden diarrhœas with which persons are sometimes surprised. It was a desperate effort of nature to save the body, for if undigested food remains too long, either in the stomach or bowels, fits, convulsions, epilepsies, apoplexies, and death, are very frequent results.

As a universal rule in health, and, with very rare exceptions, in disease, that is best to be eaten which the appetite craves or the taste relishes.

Persons rarely err in the quality of the food eaten; nature's instincts are the wise regulators in this respect.

The great sources of mischief from eating are three: Quantity, frequency, rapidity; and from these come the horrible dyspepsias which make of human life a burden, a torture, a living death.

By eating fast the stomach, like a bottle being filled through a funnel, is full and overflowing before we know it. But the most important reason is, the food is swallowed before time has been allowed to divide it in sufficiently small pieces

with the teeth; for, like ice in a tumbler of water, the smaller the bits are, the sooner are they dissolved. It has been seen with the naked eye, that if solid food is cut up in pieces small as half a pea, it digests almost as soon, without being chewed at all, as if it had been well masticated. The best plan, therefore, is for all persons to thus comminute their food, for even if it is well chewed the comminution is no injury, while it is of very great importance in case of hurry, forgetfulness, or bad teeth. Cheerful conversation prevents rapid eating.

It requires about five hours for a common meal to be dissolved and pass out of the stomach, during which time this organ is incessantly at work, when it must have repose, as any other muscle or set of muscles after such a length of effort. Hence persons should not eat within less than a five hours' interval. The heart itself is at rest more than one-third of its time. The brain perishes without repose.

All are tired when night comes; every muscle of the body is weary and looks to the bed; but just as we lie down to rest every other part of the body, if we, by a hearty meal, give the stomach five hours' work, which, in its weak state, requires a much longer time to perform than at an earlier hour of the day, it is like imposing upon a servant a full day's labor just at the close of a hard day's work; hence the imprudence of eating heartily late in the day or evening; and no wonder it has cost many a man his life.

No laborers or active persons should eat later than sun-down, and then it should not be over half the midday meal. Persons of sedentary habits or who are at all ailing should take absolutely nothing for supper beyond a single piece of cold stale bread and butter or a ship-biscuit, with a single cup of warm drink. Such a supper will always give better sleep and prepare for a heartier breakfast, with the advantage of having the exercise of the whole day to grind it up and extract its nutriment.

It is variety which oftenest tempts to excess. Many a man has been about to push himself back from the table with a feeling as if he did not want any more, when the unexpected appearance of some favorite dish has waked up a new appetite, and he "disposes" of an amount almost equal to that already taken. To prevent over-eating take food deliberately, keep up a lively conversation on pleasurable subjects during the entire repast, and avoid a variety of dishes. For ordinary purposes, there should be on the family table but one kind of bread, one kind of meat, one kind of vegetable, one kind of drink, and one kind of fruit or berries, as dessert; butter, olive-oil, salads, cream, salt, and pepper not being counted, but to be used as desired.

The most ruinous practice in reference to this subject is eating in a hurry, or under the influence of any disagreeable mental excitement, whether of anxiety, passion, or grief, for many have died within an hour by so doing.

Multitudes bring on themselves the horrors of a life-long dyspepsia by drinking large quantities of cold water at their meals, because by cooling the contents of the stomach, which maintains a heat of ninety-eight degrees, to that of the water drank at forty—ice-water being about thirty-two—digestion is as instantly arrested as a burning coal is extinguished by a dash of cold water; and this process is not resumed until heat enough has been drawn from the other parts of the body to raise the whole mass to its natural temperature; but this leaves the other parts of the system so cold that those who have not robust health sometimes rise from the table in a chill; at other times the general system, from want of vigor, has not been able to furnish the amount of heat necessary, digestion is not resumed, and diarrhœa endangers life or convulsions destroy it within a few hours. Large quantities of hot drinks at regular meals will, with equal certainty, destroy the tone of the stomach and lay the foundation for tedious and painful diseases. Invalids should never take any cold drink at meals; and whether hot or cold, they are wise and safe who never allow themselves over a quarter of a pint of any liquid at a regular meal, or within an

hour afterwards. A good position for the first half hour after eating is either to stand or sit erect; better still, walk leisurely in the open air, if not too cold, or across the room with hands behind, chin a little elevated, maintaining an agreeable frame of mind. Particularly avoid a stooping position in sewing or reading for the first hour or two after meals, and also heavy lifting, hard study, or any intense mental emotion; these are all destructive of health; and although a single slight error may do no appreciable injury, it never fails to make an impress for ill, until at last there is one repetition too much, and a painful sickness, a life-long torture, or a speedy death from heart disease, hemorrhage, or apoplexy winds up the sad history.

Never force food on the stomach. Never eat without an appetite. Never eat between meals.

Always take breakfast before leaving the house in the morning. This will prevent an easy and early tiring, while the testimony of observant farmers of education corroborates the teachings of the best medical minds, that by strengthening the stomach and sending invigorating nutriment to the whole system, weakened by the long fast of the night, there is generated a power of resistance against the onsets of disease from the cold of winter and from the malarias and miasms of summer, especially in all flat, damp, and luxuriant soils, which can not be adequately expressed in language; while both experience and experiment have combined to show that, by the simple expedient of an early breakfast, individuals and families and neighborhoods have exempted themselves from that scourge of all new countries, "fever and ague," especially if followed by a supper a little before sundown from May to November.

CATCHING COLD.

Experienced physicians in all countries very well know that the immediate cause of a vast number of cases of disease and death is a "cold;" it is that which fires a magazine of human ills; it is the spark to gunpowder. It was to a cold taken on a raw December day that the great Washington owed his death. It was a common cold, aggravated by the injudicious advice of a friend, which ushered in the final illness of Washington Irving. Almost any reader can trace the death of some dear friend to a "little cold."

The chief causes of colds are two: first, cooling off too soon after exercise; second, getting thoroughly chilled while in a state of rest without having been overheated. This latter originates dangerous pleurisies, fatal pneumonias (inflammation of the lungs) and deadly fevers of the typhoid type.

Persons in vigorous health do not take cold easily. They can do with impunity what would be fatal to the feeble and infirm. Dyspeptic persons take cold readily, but they are not aware of it, because its force does not fall on the lungs but on the liver through the skin, giving sick headache, and close questioning will soon develop the fact of some unusual bodily effort followed by cooling off rapidly.

A person wakes up some sunny morning and feels as if he had been "pounded in a bag." Every joint is stiff, every muscle sore, and a single step cannot be taken without difficulty or actual pain. Reflection will bring out some unwonted exercise, and a subsequent cooling off before knowing it—as working in the garden in the spring-time; over exertion about the house-work; showing new servants "how to do;" in going a "shopping," an expedition which taxes the mind and body to the utmost—these and similar "little nothings" rouse women's minds to a pitch of interest and excitement scarcely excelled by that of counsellors of state in determining the boundaries of empires or the fate of nations, to return home exhausted in body, depressed in mind, and thoroughly heated. The first thing done is to toss down a glass of water to cool off, next to lay aside bonnet, shawl, and "best dress," and lastly, to put on a cold dress. lie down on a bed in a fireless room and fall asleep, to wake up almost cer-

tainly with a bad cold, which is to confine to the chamber for days and weeks together, and not unseldom carries them to the grave!

A lady was about getting into a small boat to cross the Delaware; but wishing first to get an orange at a fruit stand, she ran up the bank of the river, and on her return to the boat found herself much heated, for it was summer, but there was a little wind on the water, and the clothing soon felt cold to her. The next morning she had a severe cold, which settled on her lungs, and within the year she died of consumption.

A stout, strong man was working in a garden in May. Feeling a little tired about noon, he sat down in the shade of the house and fell asleep; he waked up chilly; inflammation of the lungs followed, ending, after two years of great suffering, in consumption.

A Boston ship-owner, while on the deck of one of his vessels, thought he would "lend a hand" in some emergency, and pulling off his coat, worked with a will until he perspired freely, when he sat down to rest awhile, enjoying the delicious breeze from the sea. On attempting to rise he found himself unable, and was so stiff in his joints that he had to be carried home and put to bed, which he did not leave until the end of two years, when he was barely able to hobble down to the wharf on crutches.

A lady, after being unusually busy all day, found herself heated and tired toward sundown of a summer's day. She concluded she would rest herself by taking a drive to town in an open vehicle. The ride made her uncomfortably cool, but she warmed herself up by an hour's shopping, when she turned homeward; it being late in the evening, she found herself more decidedly chilly than before. At midnight she had *pneumonia,* (inflammation of the lungs,) and in three months had the ordinary symptoms of confirmed consumption.

A lady of great energy of character lost her cook, and had to take her place for four days; the kitchen was warm, and there was a draught of air through it. When the work was done, warm and weary, she went to her chamber, and lay down on the bed to rest herself. This operation was repeated several times a day. On the fifth day she had an attack of lung fever; at the end of six months she was barely able to leave her chamber, only to find herself suffering with all the more prominent symptoms of confirmed consumption; such as quick pulse, night and morning cough, night-sweats, debility, short breath, and falling away.

A young lady rose from her bed on a November night, and leaned her arm on the cold window-sill to listen to a serenade. Next morning she had *pneumonia,* and suffered the horrors of asthma for the remainder of a long life.

Farmers' wives lose health and life every year in one of two ways: by busying themselves in a warm kitchen until weary, and then throwing themselves on a bed or sofa without covering, and perhaps in a room without fire; or by removing the outer clothing, and perhaps changing the dress for a more common one, as soon as they enter the house after walking or working. The rule should be invariable to go at once to a warm room and keep on all the clothing at least for five or ten minutes, until the forehead is perfectly dry. In all weathers, if you have to walk and ride on any occasion do the riding first.

An engineer, in the vigor of manhood, brought upon himself an incurable disease through a cold taken by standing on a zinc floor as soon as he left his bed in the morning, while he washed himself. Many a farmer's wife or daughter has lost her life by standing on a damp floor for hours together on washing days.

A young lady, the only daughter of a rich citizen, stood an hour on the damp grass, while listening to the music in the Central Park; the next day she was attacked with inflammation of the lungs, of which she died within a week.

An estimable lady, a farmer's wife, busied herself in household affairs on a summer's day; late in the afternoon, having perspired a good deal and being

weary, she rode to town in an open vehicle to do some shopping; finding herself a little chilly, she walked rapidly on leaving her carriage, and soon became comfortably warm again. While shopping it rained. After the shower she started homeward in a cool wind; this checked the perspiration the second time, and with all available precaution she reached home chilled through and through, and died the victim of consumption within the year.

A farmer's daughter "went a berrying;" the ground was flat and a little marshy; her shoes were thin, and by the excitement of company she remained several hours. She was ill next day. Four years later she stated to her physician that she had not seen a well hour since. She was then in the last stages of a hopeless decline, and died soon after.

A little attention would avert a vast amount of human suffering in these regards. Sedentary persons, invalids, and those in feeble health, should go directly to a fire after all forms of exercise, and keep all the garments on for a few minutes; or, if in warm weather, to a closed apartment, and, if anything, throw on an additional covering. When no appreciable moisture is found on the forehead the out-door garments may be removed. The great rule is, cool off very slowly always after the body has in any manner been heated beyond its ordinary temperature.

The moment a man is satisfied he has taken cold let him do three things: First, eat nothing; second, go to bed, cover up warm in a warm room; third, drink as much cold water as he can, or as he wants, or as much hot herb tea as he can; and in three cases out of four he will be almost well in thirty-six hours; if not, send for an educated and experienced physician at once, for any "cold" which does not "get better" within forty-eight hours is neither to be trifled with nor experimented upon.

DRESS.

The main object of dress is not to impart warmth, but to keep the natural warmth about the body, and thus prevent those sudden and fatal changes from heat to cold which occur in passing from an in-door temperature of sixty-five degrees to that of zero or lower without, as in mid-winter. The temperature of the northern States varies over a hundred degrees during the year, sometimes nearly half that within twenty-four hours. Dress provides against these destructive sudden changes, by maintaining the warmth of the skin at its natural state, which is ninety-eight degrees, whether a man is on an iceberg in Greenland or on a sand island in a tropical sea. The materials of clothing which best keep the heat about the body are called *non*-conductors, such as furs and woollens, while the conductors are such as cool the body, by conveying the natural heat from it with great rapidity; the greater conducting ability is measured by the greater coldness which an article causes on the first instant of its application. In the very coldest weather fur and woollen flannel appear but a little cool, and that but for an instant, and the next there is a sensation of increasing, comfortable warmth; cotton flannel feels colder than woollen, silk colder than cotton, Irish linen colder than silk, and damp Irish linen greatly colder than either A damp woollen shirt feels but a little cold, and begins to get warm and dry in an instant, even if the person is in a profuse perspiration; while an Irish linen or silk shirt, if damp with perspiration or otherwise, feels cold and clammy and sepulchral on the instant of its touching the skin, and will remain so for hours without getting dry, never failing to leave a cold in some troublesome or even dangerous form; hence, as persons perspire easily and profusely in summer, Irish linen cannot be worn in warm weather with impunity by the working classes and those liable to perspiration from a little walking or exercise. Thus it is that British sailors in the navy are compelled to wear woollen flannel shirts all the year and in all latitudes—in the north, because it keeps the natural warmth from escaping from the body, thus main-

taining a temperature of ninety-eight degrees about the skin; and in hot climates in summer because, although woollen is a bad conductor of heat, it is a good conductor of water; for, if a woollen blanket is thrown over a sweating horse, in a very short time his hair and the inner side of the blanket will be dry, while the microscope will discover the whole outside surface spangled with millions of tiny drops of water. For these reasons woollen flannel should be worn next the skin by all our people from one year's end to another—a gauze material in summer; in winter a more substantial article. White flannel fulls up, and becomes hard and stiff unless about a fifth of it is cotton. Colored flannel, especially the red, always remains soft and pliable. These things are indisputably true, and a practical attention to them, on the part of all hard-working people, would prevent an amount of pain and sickness every year which figures cannot express. This would be especially true if, in warm weather, when fires are not needed in the house, farmers and other laborers would wear a moderately stout article of red woollen flannel as a shirt, with nothing over it while at work, but at other times a thin coat over that. Any flannel garment worn during the day should be hung up to air at night, while the night-gown all the year round should be of stout cotton shirting, for if woollen is worn next the skin all the time it makes it callous, and is otherwise injurious. The best, safest, and most healthful head-dress for farmers and workmen all the year round is a common, easy-fitting wool or felt hat; in winter it keeps the head warm; in summer it is a great protection against sun-stroke, especially if a silk handkerchief or a few leaves of a tree are worn in the crown. Such a hat is a great preventive of baldness, if worn from early youth, because it allows the blood to flow freely to and from the scalp; but if the vessels are compressed, as is done by the common unyielding silk hat, the free circulation of the blood is obstructed, and the nourishment of the hair-roots or bulbs being cut off, the hair perishes irretrievably, causing all the discomforts and inconveniences of baldness.

Death often comes to the honest laborer, as well as to others, through the feet, either by tightly-fitting shoes, which, by obstructing the circulation, keep the feet cold, thus laying the foundation for troublesome diseases, or by shoes which do not keep out the dampness. In purchasing new shoes, or having the measure taken, put on two pairs of woollen socks, without the knowledge of Crispin, and the new pair will feel from the first "as easy as an old shoe."

A piece of tarred or pitch cloth sewed between the layers of the shoe-sole is a great protection against dampness from without; or take pitch, not hot enough to burn the leather, and apply it to the bottom and edges of the sole with a rag, let it dry thoroughly, and repeat the application thus three or four times; it is contended that a sole thus treated will not only be impervious to water and dampness, but will wear nearly twice as long as a sole not thus treated. It is an excellent plan to have two pairs of shoes, to be worn on alternate days, so as to have a perfectly dry pair to put on every morning, allowing the unworn ones to remain in a warm, dry place. Washing the feet every night in warm weather, and soaking them in warm water for ten minutes three times a week in winter, admirably promotes that warmth, pliability, and softness of the skin of the feet, so indispensable to health and comfort, saying nothing of the cleanliness of the practice, and its tendency both to prevent and to cure corns. But after all washings of the feet it is of the first importance, after wiping them well, to hold them to the fire and rub them with the hands until perfectly dry and warm in every part.

It will be useful to add here, in reference to corns, that they are caused by pressure and by friction also; hence they may be the result of a shoe that is either too tight or too loose. They can be always either permanently cured or kept within bounds by simply soaking the corn in hot water twenty minutes every night, and then patiently rub a few drops of sweet oil on the top of the

corn; repeat the oil in the morning, and continue these until the core of the corn can be picked out with the finger-nail; nothing harder or sharper should ever touch a corn.

PART II.

HARDSHIPS OF FARMERS' WIVES.

A sad record is it, and short! but its details would fill whole shelves of a library, more intensely interesting than any tale fancy ever told, as found in an official report for 1862, made to the legislature of an agricultural State, that of six hundred and seven patients in an insane asylum thirty-nine were farmers' wives, sixteen farmers' daughters; no other class of wives or daughters was half as numerous! and this in spite of all that has been said and sung of the dairy-maid, so ruddy of cheek, where the roses and the lily vie, so lithe of limb, whose breath as pure as the air of the morning, whose laugh as merry as the voices of the birds in the wood, and whose step as springy and elastic as the new-made bow; all these bright fancies vanish like mists of the morning before a summer's sun, in face of the hard, dry, and statistical line written above; and there comes up another vision, not of youth and beauty and innocence and exuberant health, but that of the pale and wan and haggard face, half covered with long black hair, and coal black eyes peering hotly on you from behind the bars and grates of a dark prison-house! True, happily true is it, that this state of things is not part and parcel, necessarily, of the farmhouse; it is not an inherent calamity; it is only an accidental circumstance, which can be remedied promptly and forever; and it is because of this delightful truth these pages are written. Fortunately, it cannot be denied that there is scarcely any lot in life, in this country, which promises so much quiet enjoyment, such uniform health and uninterrupted prosperity, as that of a gentleman farmer's wife; of a man who has a well-improved, well-stocked plantation, all paid for, with no indebtedness, and a sufficient surplus of money always at command to meet emergencies and to take advantage of those circumstances of times and seasons and changing conditions which are constantly presenting themselves. Such a woman is incomparably more certain of living in quiet comfort to a good old age than the wife of a merchant-prince, or one of the money-kings of Wall street; who, although they may clear thousands in a day, do, nevertheless, in multitudes of cases, die in poverty, leaving their wives and daughters to the sad heritage of being slighted and forgotten by those who once were made happy by their smiles; and to pine away in tears and destitution. On the other hand, it is often a sad lot indeed to be the wife of a farmer who begins married life by renting a piece of land or buying a "place" on credit, with the moth of "interest" feeding on the sweat of his face every moment of his existence.

The affectionate and steady interest, the laudable pride, and the self-denying devotion which wives have for the comfort, prosperity, and respectability of their husbands and children, is a proverb and a wonder in all civilized lands. There is an abnegation of self in this direction as constant as the flow of time; so loving, so uncomplaining, so heroic, that if angels make note of mortal things they may well look down in smiling admiration. But it is a melancholy and undeniable fact that, in millions of cases, that which challenges angelic admiration fails to be recognized or appreciated by the very men who are the incessant objects of these high, heroic virtues. In plain language, in the civilization of the latter half of the nineteenth century, a farmer's wife, as a too general rule, is a laboring drudge; not of necessity by design, but for want of that consideration, the very absence of which, in reference to the wife of a man's youth, is a crime. It is perhaps safe to say, that on three farms out of four the wife works harder, endures more, than any other on the place; more than the husband, more than the "farm-hand," more than the "hired help"

of the kitchen. Many a farmer speaks to his wife habitually in terms more imperious, impatient, and petulant than he would use to the scullion of the kitchen or to his hired man.

2. In another way a farmer inadvertently increases the hardships of his wife; that is, by speaking to her or treating her disrespectfully in the presence of the servants or children. The man is naturally the ruling spirit of the household, and if he fails to show to his wife, on all occasions, that tenderness, affection, and respect, which is her just due, it is instantly noted on the part of menials, and children too, and they very easily glide into the same vice, and interpret it as an encouragement to slight her authority, to undervalue her judgment, and to lower that high standard of respect which of right belongs to her. And as the wife has the servants and children always about her, and is under the necessity of giving hourly instructions, the want of fidelity and promptness to these is sufficient to derange the whole household, and utterly thwart that regularity and system, without which there is no domestic enjoyment, and but little thrift on the farm.

The indisputable truth is, that there is no other item of superior, or perhaps equal, importance, in the happy and profitable management of any farm, great or small, than that every person on it should be made to understand that deference and respect and prompt and faithful obedience should be paid, under all circumstances, to the wife, the mother, and the mistress; the larger the farm, the greater interests there are at stake. If poor, then the less ability is there to run the risk of losses which are certain to occur in the failure of proper obedience. An illustration: a tardy meal infallibly ruffles the temper of the workmen, and too often of the husband; yet all the wife's orders were given in time; but the boy has lagged in bringing wood; or the girl failed to put her loaf to bake in season, because they did not fear the mistress, and the master was known not to be very particular to enforce his wife's authority. If by these causes a dinner is thrown back half an hour, it means on a good-sized farm a loss of time equivalent to the work of one hand a whole day; it means the very considerable difference between working pleasantly and grumblingly the remainder of the day; it means, in harvest time, in showery weather, the loss of loads of hay or grain.

3. Time and money and health, and even life itself, are not unfrequently lost by want of promptitude on the part of the farmer in making repairs about the house, in procuring needed things in time, and in failing to have those little conveniences which, although their cost is even contemptible, are in a measure practically invaluable. The writer was in a farmer's house one night, where the wife and two daughters were plying their needles industriously by the dim light of a candle, the wick of which was frequently clipped off by a pair of scissors. And yet this man owned six hundred acres of fine grazing lands, and every inch paid for. I once called on an old friend, a man of education, and of a family loved and honored all over his native State. His buildings were of brick, in the centre of an inherited farm of several hundred acres. The house was supplied with the purest, coldest, and best water from a well in the yard; the facilities for obtaining which were a rope, one end of which was tied to a post, the other to an old tin pan, literally. The discomfort and unnecessary labor involved in these two cases may be estimated by the reader at his leisure.

I know it to be the case, and have seen it on many western farms, when firewood was wanted, a tree was cut down and hauled bodily to the door of the kitchen; and when it was all gone another was drawn up to supply its place, giving the servant and the wife green wood with which to kindle and keep up their fires.

There are thousands of farms in this country where the spring which supplies all the water for drink and cooking is from a quarter to half a mile distant from the house, and a "pailful" is brought at a time, involving five or

ten miles' walking in a day, for months or years together, when a little mechanical ingenuity or a few dollars expense would bring the water to the door. How many weeks of painful and expensive sickness; how many lives have been lost of wives and daughters and servants, by being caught in a shower between the house and the spring, while in a state of perspiration or weakness from working over the fire, cannot be known, but that they may be numbered by thousands will not be intelligently denied.

Many a time a pane of glass has been broken out, or a shingle has been blown from the roof, and the repair has not been made for weeks or many months together; and for want of it have come agonizing neuralgias; or a child has waked up in the night with the croup, to get well only with a doctor's bill, which would have paid twenty times for the repair, even if a first-born has not died, to agonize a mother's heart to the latest hour of life; or the leak in the roof has remained, requiring the placing of a bucket or the washing of the floor at every rain.

4. Cruelties are thoughtlessly sometimes, and sometimes recklessly, perpetrated by farmers on their wives, as follows: a child or other member of the family is taken sick in the night; the necessary attention almost invariably falls on the wife, to be extended through a greater part, if not the whole night. Wearied with the previous day's duties, with those solicitudes which always attend sickness; with the responsibilities of the occasion, and a loss of requisite rest, the wife is many times expected to "see to breakfast" in the morning, as if nothing had happened. The husband goes to his work, soon becomes absorbed in it, and forgets all about the previous night's disturbance; meets his wife at the dinner-table; notices not the worn-out expression on her face; makes no inquiry as to her feelings; and if anything on or about the table is not just exactly as it ought to be, it is noticed with a harshness which would be scarcely excusable if it had been brought about with a deliberate calculation.

The same thing occurs multitudes of times during the nursing periods of mothers; how many nights a mother's rest is broken half a dozen times by a restless, crying, or ailing infant, every mother and observant man knows. In such cases the farmer goes into another room, and sleeps soundly until the morning; and yet, in too many cases, although this may be, and is repeated several nights in succession, the husband does not hesitate to wake his wife up with the information that it is nearly sunrise, the meaning of which is, that he expects her to get up and attend to her duties. No wonder that in many of our lunatic asylums there are more farmers' wives than any other class; for there is no fact in medical science more positively ascertained than that insufficient sleep is the most speedy and certain road to the madhouse. Let no farmer, then, let no mechanic, let no man, who has any human sympathy still left, allow his wife to be waked up in the morning except from very urgent causes; and, further, let them give every member of the household to understand that quietude about the premises is to be secured always until the wife leaves her chamber; thus having all the sleep which nature will take, the subsequent energy, cheerfulness, and activity which will follow will more than compensate for the time required to "get her sleep out," not only as to her own efficiency, but as to that of every other member of the household; for let it be remembered that a merry industry is contagious.

There are not a few farmers whose imperious wills will not brook the very slightest dereliction of duty on the part of any hand in their employ, and whose force of character is such that everything on the farm, outside the house, goes on like clockwork. They look to their wives to have similar management indoors, and are so swift to notice even slight shortcomings, that at length their appearance at the family table has become inseparable from scenes of jarring, fault-finding, sneering, depreciating comparisons, if not of

coarse vituperation; and all this simply from the failure to remember that they have done nothing to make the wife's authority in her domain as imperative as their own. They make no account of the possible accidents of green wood to cook with; of an adverse wind which destroys the draught of the chimney; of the breaking down of the butcher's cart, or of their own failure to procure some necessary material. They never inquire if the grocer has not sent an inferior article, or an accident has befallen the stove or some cooking utensil. It is in such ways as these, and many more like them, that the farmer's wife has her whole existence poisoned by those daily tortures which come from her husband's thoughtlessness, his inconsideration, his hard nature, or his downright stupidity. A wife naturally craves her husband's approbation. "Thy desire shall be to thy husband" is the language of Scripture, which, whatever may be the specific meaning of the quotation, certainly carries the idea that she looks up to him with a yearning inexpressible, for comfort, for support, for smiles and sympathy; and when she does not get these, the whole world else is a waste of waters, or life a desert, as barren of sustenance as the great Sahara. But this is only half the sorrow. When, in addition to this want of approbation and sympathy, there comes the thoughtless complaint; the remorseless and repeated fault-finding and the contemptuous gesture, when all was done that was possible under the circumstances—in the light of treatment like this, it is not a wonder that settled sadness and hopelessness is impressed on the face of many a farmer's wife, which is considered by the thoughtful physician as the prelude to that early wasting away which is the lot of many a virtuous and faithful and conscientious woman.

The attentive reader will not fail to have observed that the derelictions adverted to on the part of farmer husbands are not regarded necessarily as the result of a perverse nature, but rather in the main from inconsideration or ignorance; but, from whatever cause, the effect is an unmixed evil, and it is to be hoped that our religious papers and all agricultural publications will persistently draw attention to these things, so as to excite a higher sentiment in this direction. It can be done and ought to be done; and it is highly creditable to the Department of Agriculture to have expressly desired that an article should be written on the subject of the hardships and the unnecessary exposures of farmers' wives, to the end that information and instruction should be imparted in this direction.

There are some suggestions to be made with a view to lightening the load of farmers' wives, the propriety, the wisdom, and advantages of which cannot fail to be impressed on every intelligent mind.

1. A timely supply of all that is needed about a farmer's house and family is of incalculable importance; and when it is considered that most of these things will cost less to get them in season, and also that a great deal of unnecessary labor can be avoided by so doing, it would seem only necessary to bring the fact distinctly before the farmer's mind to secure an immediate, an habitual, and a life-long attention. The work necessary to keep a whole household in easily running order is very largely curtailed by having everything provided in time, and by taking advantage of those little domestic improvements devised by busy brains, and which are brought to public notice weekly in the columns of our agricultural papers.

2. It requires less time and less labor to have the winter's wood for house-heating and cooking brought into the yard and piled up cozily under a shed or placed in a wood-house in the fall, than to put it off until the last moment, when perhaps it is saturated with water, or, still worse, to compel the women to use green wood, and perhaps to cut and split it at that.

3. It is incalculably better to have the potatos and other vegetables gathered and placed in the cellar or in an outhouse near by in the early fall,

so that the cook may get at them under cover, than to put it off week after week, until near Christmas, compelling the wife and servants, once or twice every day, to leave a heated kitchen, and most likely with thin shoes, go to the garden with a tin pan and a hoe, to dig them out of the wet ground and bring them home in slosh or rain. The truth is, it perils the life of the hardiest persons, while working over the fire in cooking or washing, to go outside the door of the kitchen for an instant; a damp, raw wind may be blowing, which, coming upon an inner garment, throws a chill or the clamminess of the grave over the whole body in an instant of time, to be followed by the reaction of fever or fatal congestion of the lungs; or by making a single step in the mud, which is in thousands of cases allowed to accumulate at the very door-sill for want of a board or two, or a few flat stones, not a rod away.

4. No farmer's wife who is a mother ought to be allowed to do the washing of the family; it is perilous to any woman who has not a vigorous constitution. The farmer, if too poor to afford help for that purpose, had better exchange a day's work himself. There are several dangers to be avoided while at the tub. It requires a person to stand for hours at a time. This is a strain upon the young wife or mother, which is especially perilous; besides, the evaporation of heat from the arms, by being put in warm water and then raised in the air alternately, so rapidly cools the system that inflammation of the lungs is a very possible result. Then the labor of washing excites perspiration and induces fatigue; in this condition the body is so susceptible to taking cold that a few moments' rest in a chair, or exposure to a draught of air, especially in hanging out clothes, is quite enough to cause a chill, with results painful or even dangerous, according to the particular condition of the system at the time. No man, however poor, has a right to risk his wife's health in this way, if he has vigorous health himself; and, if poor, he cannot afford, for the three to six shillings which would pay for a day's washing, to risk his wife's health, her time for two or three weeks, and the incurring of a doctor's bill, which it may require painful economies for months to liquidate.

5. Every farmer owes it to himself, in a pecuniary point of view, and to his wife and children, as a matter of policy and affection, to provide the means early for clothing his household according to the seasons, so as to enable them to prepare against winter especially. Every winter garment should be completed by the first of November, ready to be put on when the first winter day comes. In multitudes of cases valuable lives have been lost to farmers' families by improvidence as to this point. Most special attention should be given to the under clothing; that should be prepared first, and enough of it to have a change in case of an emergency or accident. Many farmers act even niggardly in furnishing their wives the means for such things. It is far wiser and safer to stint the members of his family in their food than in the timely and abundant supply of substantial under clothing for winter wear. It would save an incalculable amount of hurry and its attendant vexations, and also of wearing anxiety, if farmers were to supply their wives with the necessary material for winter clothing as early as midsummer. In this connexion it would be well for farmers to learn a lesson of thrift from some of our long-headed city housewives. It is particularly the habit of the well-to-do, the forehanded, and the rich—by which they legally and rightfully get at least twenty per cent. for their money—to purchase the main articles of clothing at the close of any season, to be made up and worn the corresponding season of the next year. Merchants uniformly aim, especially in cities, to "close out" their stocks, for example, for the winter, at the end of winter or beginning of spring. They consider it profitable to sell out the remnant of their winter stock in March at even less than cost, for on what they get for these remnants they make three profits—on the spring, the summer, and the fall goods—whereas had they laid by their winter stock they would have had but one profit, from

vhich would have to be deducted the yearly interest, storage, and insurance. Thus by purchasing clothing materials six or eight months beforehand, the armer not only saves from twenty to forty per cent. of the first cost, but ives his wife the opportunity of working upon them at such odds and ends of ime as would otherwise be unemployed in a measure, and would enable her lso to have everything done in a better manner, simply by having abundant ime, thus avoiding haste, vexation, solicitude, and disappointment, for nothing o clouds a household as a sense of being behindhand and of the necessity of ainful hurry and effort.

6. Few things will bring a more certain and happy reward to a farmer than or him to remember his wife is a social being; that she is not a machine, and herefore needs rest, and recreation, and change. No farmer will lose in the ong run, either in money, health, or domestic comfort, enjoyment and down-ight happiness, by allotting an occasional afternoon, from mid-day until bed-ime, to visiting purposes. Let him, with the utmost cheerfulness and hearti-ess, leave his work, dress himself up, and take his wife to some pleasant eighbor's, friend's, or kinsman's house, for the express purpose of relaxation rom the cares and toils of home, and for the interchange of friendly feelings nd sentiments, and also as a means of securing that change of association, ir, and food, and mode of preparation, which always wakes up the appetite, nvigorates digestion, and imparts a new physical energy, at once delightful o see and to experience; all of which, in turn, tend to cultivate the mind, to ourish the affections, and to promote that breadth of view in relation to men nd things which elevates, and expands, and ennobles, and without which the vhole nature becomes so narrow, so contracted, so barren and uninteresting, hat both man and woman become but a shadow of what they ought to be.

7. Let the farmer never forget that his wife is his best friend, the most teadfast on earth; would do more for him in calamity, in misfortune, and ickness than any other human being, and on this account, to say nothing of he marriage vow, made before high Heaven and before men, he owes to the vife of his bosom a consideration, a tenderness, a support, and a sympathy, vhich should put out of sight every feeling of profit and loss the very instant hey come in collision with his wife's welfare as to her body, her mind, and er affections. No man will ever lose in the long run by so doing; he will ot lose in time, will not lose in a dying hour, nor in that great and mysterious uture which lies before all.

8. There are "seasons" in the life of women which, as to some of them, o affect the general system, and the mind also, as to commend them to our varmest sympathies, and which imperatively demand from the sterner sex the ame patience, and forbearance, and tenderness which they themselves would vant meted out to them if they were not of sound mind. At these times ome women, whose uniform good sense, propriety of deportment, and amia-ility of character command our admiration, become so irritable, fretful, com-laining, quarrelsome, and unlovely as to almost drive their husbands mad. Their conduct is so inexplicable, so changed, so perfectly causeless that they re almost overcome with desperation, with discouragement, or indignant defi-nce of all rules of justice, of right, or of humanity. The ancients, noticing his to occur to some women for a few days in every month, gave it the appel-ation of "lunacy," *luna* being the Latin name for moon or monthly. Some vomen, at such times, are literally insane, without their right mind, and, as t is an infliction of nature, far be it from any husband, with the feelings of a nan, to fail at such times to treat his wife with the same kind care, and extra enderness, and pitying love that he would show to a demented only child. The skillful physician counsels in such cases the scrupulous avoidance of every vord, or action, or even look which by any possibility could irritate the mind, xcite the brain, or wound the sensibilities, and, as far as possible, to yield

gracefully and good-naturedly to every whim and every caprice; to seem to control in nothing, to yield in all things. Under these calming influences the mind sooner resumes its wonted rule; the heart gushes out in new loves and wakes up to a warmer affection than was ever known before. A misunderstanding of the case and an impatient resistance at all points has before now driven women to desperation, to a life-long hate, to suicide, or to a fate worse than all—to peer through the iron bars of a lunatic's cell for a long and miserable lifetime. Let every husband who has a human heart consider the subject well.

9. In these and other peculiar states of the system, arising from nervous derangement, women are sometimes childish, and various curious phenomena take place. There is an inability to speak for a moment or a month, the heart seems to "jump up in the mouth," or there is a terrible feeling of impending suffocation. At other times there are actual convulsions, or an uncontrollable bursting out into tears. These and other disagreeable phenomena are derisively and unfeelingly called "hysterics" or "nervousness," but they are no more unreal to the sufferer than are the pains of extraction for "nothing but the toothache." These symptoms are not unfrequently set down to the account of perverseness when it should no more be done than to call it perversity to break out in uncontrollable grief at the sudden information of the death of the dearest friend on earth. The course of conduct to be pursued in cases of this kind is at once the dictate of science, of humanity, and of common sense; it is to sympathize with and soothe the patient in all ways possible, until the excess of perturbation has passed away, and the system calms down to its natural, even action.

10. Unless made otherwise by a vicious training a woman is as naturally tasteful, tidy, and neat in herself, and as to all her surroundings, as the beautiful canary, which bathes itself every morning, and will not be satisfied until each rebellious feather is compelled to take the shape and place which nature designed. It is nothing short of brutality to war against those pure elevating and refining instincts of a woman's better nature, and it is a husband's highest duty, his interest, and should be his pleasure and his pride, to sympathize with his wife in the cultivation of these instincts, and to cheerfully afford her the necessary means, as far as he can do so consistently. No money is better spent on a farm, or anywhere else, than that which enables the wife to make herself, her children, her husband, and her house appear fully up to their circumstances. The consciousness of a torn or buttonless jacket or soiled dress worn at school degrades a boy or girl in their own estimation, and who that is a man does not hate to feel that he is wearing a ragged or dirty shirt? The wife who is worthy of the name will never allow these things if she is provided with means for their prevention, and it is in the noble endeavor to maintain for herself and family a respectability of appearance which their station demands, with means and help far too limited, which so irritates and chafes and annoys her proper pride that many a time the wife's heart and constitution and health are all broken together. This is the history of multitudes of farmers' wives, and the niggardly natures which allow it, after taking an intelligent view of the subject, are simply beneath contempt. What adds to the better appearance of the person elevates; what adds to the better appearance of a farm increases its value and the respectability of the occupant; so that it is always a good investment, morally and pecuniarily, for a farmer to supply his wife generously and cheerfully, according to his ability, with the means of making her family and home neat, tasteful, and tidy. A bunch of flowers or a shilling ribbon for the dress, or a few pennies' worth of lime or a dollar's worth of paint for the house, may be so used as to give an impression of life. of cheerfulness, and of thrift about a home altogether beyond the value of the means employed for the purpose.

Many a farmer's wife is literally worked to death in an inadvertent manner from want of reflection or consideration on the part of her husband. None can understand better than he, in ploughing, or sowing, or harvest time, that if a horse gets sick, or runs away, or is stolen, another must be procured that very day or the work will inevitably go behindhand. He does not carry the same practical sense into the kitchen when the hired help leaves without warning or becomes disabled, although he knows as well as any man can know that "the hands" will expect their meals with the same regularity, with the same promptness, and with the same proper mode of preparation; but, instead of procuring other "help" on the instant, he allows himself to be persuaded, if the "help" is sick, she will get well in a day or two, or in a week at furthest, and that it is hardly worth while to get another for so short a time. If the "help" has taken "French leave" his mind fixes on the fact that it is a very busy time, and neither he nor a single hand can be spared, or that, in the course of a week, some one will have to go to town for some other purpose, and both these matters can be attended to at the same time. Meanwhile the wife is expected not only to attend to her ordinary duties as usual, but somehow or other to spare the time to do all that the cook or washerwoman was accustomed to, that is, to do the full work of two persons, each one of whom had already quite as much labor to perform as she could possibly attend to. The wife attempts it. By herculean efforts all goes on well. The farmer perceives no jar, no hitch in the working of the machinery, and, because no complaint is uttered, thinks that everything is going on without an effort. Meanwhile time passes, and (infinite shame on some of them) they begin to calculate how much has been saved from servants' wages, and how much less food has been eaten, and, because still no complaint is made, the resolution quietly forms in the mind to do nothing until she does complain; but, before that takes place, she falls a victim to her over-exertions, in having laid the foundation for weeks and months of illness, if not of a premature decline and death. Sincerely it is believed that these statements ought to be written in large letters above the mantels of half the farmers of the country, and, if over the other half also, it would not be labor lost in favor of many a heroic and uncomplaining but outraged farmer's wife and daughter.

Let all, especially the young, who look to farming as the future pursuit of life, and who desire to avoid a large share of the ordinary discomforts, privations, unhappiness, and want of health which too often befall so worthy and so large a class of society as farmers' families are, remember these two cardinal suggestions:

First. Never purchase more land for farming purposes than can be paid for without borrowing.

Second. Never attempt to cultivate more than can be thoroughly done with the help which can be readily commanded; for one acre will yield more with a given amount of well-expended labor than two acres will yield with the same.

Finally, let the farmer always remember that his wife's cheerful and hearty co-operation is essential to his success, and is really of as much value in attaining it, all things considered, as anything that he can do; and, as she is very certainly his superior in her moral nature, it legitimately follows that he should not only regard her as his equal in material matters, but should habitually accord to her that deference, that consideration, and that high respect which is of right her due, and which can never fail to impress on the children and servants, who daily witness it, a dignity and an elevation of manner, and thought, and feeling, and deportment which will prove to all who see them that the wife is a lady, and the husband a man and a gentleman, and large pecuniary success, with a high moral position and wide social influence will be the almost certain results.

The remedy for the startling evil, which the official statement made in the

beginning brings to light, is in the husband and mother. Let the farmer feel that his wife is an equal partner on the farm, and as such is entitled to as high consideration as he claims for himself. He should have a jealous care for the "good name of the house." Let him feel that what degrades his wife degrades himself, that whatever weakens her authority weakens his own power of success, and that in the great struggle of life they must of necessity rise or fall together. But while he cherishes these views as a business matter, as a practical thing of profit and loss, let him make an effort in another direction, not considering his wife merely as his partner in business, but as the love of his youth, who having, in a perfect abandon of trustfulness, thrown herself into his strong arms to be guided, protected, and sustained through life's long journey, has claims on him for these stronger than any tie other than that which binds man to Divinity; so strong indeed, that inspiration has declared, that in heaven was it made, and by Heaven only can it be unloosed; and feeling thus, let him see in the wife of his bosom, though she may be all wrinkled with age, only the fair and loving and the fondly trusting girl as she appeared at the moment of saying "I will" many years agone. Let the mother also busy herself in teaching her daughters what they ought to do, what they have a right to expect in the marriage relation; and above this even, let her inculcate on her sons, day by day, with wisdom and tenderness, charging them lovingly to remember when she is dead and gone, by all the respect and reverence and affection which they may have for her memory, to treat, for her sake, the wives of their bosoms with all that affection and tenderness and consideration and sympathy which they would have their father show her if she could but be brought back again, or which they themselves would gladly show her if they had the opportunity.

THE PRESERVATION OF FOOD.

BY PROF. L. C. LOOMIS, M. D.

As food is the greatest want of man, it would hardly need the demonstrations of statistics to show that a preponderating share of human labor must be devoted to its production, or that the value of food in any country must exceed that of any other specific production. Yet, before entering upon a discussion of the methods of its preservation, it would be appropriate to seek some approximate estimate of the values we propose preserving; otherwise, though our general idea may be correct, we shall fail to be impressed with the immensity of their extent and importance.

Taking the statistics of the census of 1860, we have the following statement of chief articles of food:

Wheat, bushels	171, 000, 000
Corn, bushels	830, 000, 000
Peas and beans, bushels	15, 000, 000
Sweet potatos, bushels	41, 000, 000
Orchards, (value)	$20, 000, 000
Slaughtered animals	$212, 000, 000
Rye, bushels	21, 000, 000

Rice, pounds	187,000,000
Potatos, bushels	110,000,000
Buckwheat, bushels	18,000,000
Market gardens	$15,000,000
Dairy products	$166,000,000

Estimating the values of these products at medium market prices, we have the following aggregates:

Money value of certain products.

Wheat, at $1 per bushel	$171,000,000
Rye, at 70 cents per bushel	14,700,000
Corn, at 50 cents per bushel	415,000,000
Peas, beans, at $2 per bushel	30,000,000
Potatos, at 50 cents per bushel	55,000,000
Potatos, sweet, at 75 cents per bushel	30,000,000
Buckwheat, at 50 cents per bushel	9,000,000
Orchards	20,000,000
Market gardens	15,000,000
Dairy products	166,000,000
Animals, slaughtered	212,000,000
Sugar	40,000,000
Gardens, (estimated)	30,000,000
Fish	13,000,000
	1,220,700,000

In round numbers, twelve hundred million dollars.

Let us now compare, with these fourteen food products, fourteen of the largest other products in the various departments of human labor:

Hay, 19,129,000 tons, at $12 per ton	$229,548,000
Cotton, 5,198,000 bales, at $50 per bale	259,900,000
Wool, 60,500,000 pounds, at 50 cents per pound	30,250,000
Cotton goods, $115,000,000, (deducting one-third for raw material)	77,000,000
Shoes, $90,000,000, (deducting one-third for raw material)	60,000,000
Clothing, $70,000,000, (deducting one-third for raw material)	47,000,000
Woollen goods, $67,000,000, (deducting for raw material)	45,000,000
Lumber	96,000,000
Machinery	47,000,000
Printing	42,000,000
Iron	28 000,000
Furniture	24,000,000
Bar iron	22,000,000
	1,007,698,000

Amounting, in round numbers, to about one thousand millions of dollars From this brief examination it appears a just conclusion that in this country the aggregate value of food products must nearly equal, if not in fact exceed, the combined value of all the other varied departments of human labor.

The most important distinction in these two classes of values is their *stability;* the one being eminently *perishable,* and the other, for the most part, quite *permanent.* Cotton, wool, iron, and their fabrics, hay, lumber, &c., may

depreciate in the course of a year or two, but they still remain with a high per cent. of their original value, while the greater number of fruits, vegetables, grains, and meats become valueless or entirely perish.

This peculiarity of food, this tendency to decomposition, from which arise, necessarily, methods of preservation, originates in its chemical constitution. In their natural condition, whilst certain particles of matter are inert or repellant towards others, other particles are acted upon by positive affinities, giving rise, thus, to certain natural compounds, usually consisting of two or four elements. But when the simple elementary particles are acted upon by either vegetable or vital force, they are grouped together in large combinations altogether regardless of affinities or repulsions. The stability of this new, living compound, depending, therefore, upon the relative power of its combined chemical and vital forces, and the decomposing agencies, if its particles have of themselves a good degree of natural affinity, life will be tenacious, and decay correspondingly slow; but if, on the other hand, the particles are naturally repellant, life will easily yield, and decay will progress with rapidity.

Preservation consists in checking or preventing this chemical decomposition; its intelligent pursuit must, therefore, rest upon an understanding of the chemical structure of the bodies to be preserved, and the forces which are acting to conserve or destroy. No very accurate classification of food can be made, but for our present purposes it will be sufficient to make the general distinctions of grain, fruits, vegetables, lean meat, and fat. The chief component elements of these are—

Grain.—Albumen, starch.
Fruits.—Sugar, water, cellulose, and acid.
Vegetables.—Starch, sugar, water, cellulose.
Meat, lean.—Albumen, fibrin.
Meat, fat.—Oil.

These proximate principles having a fixed composition as to number and kind of elements, have each their own status of durability and their own laws of decomposition. Starch has a tendency toward the saccharine fermentation, or to change into sugar; sugar, to the vinous fermentation, or to change into acid; albumen and fibrin, to direct decomposition; cellulose, to unite with oxygen; while the oils are nearly fixed. But for either of these changes oxygen is required, for if no oxygen is supplied, in many cases the decomposition is, to a large extent, arrested or wholly prevented.

From this it appears that one of the most important means of preserving, or holding in their present combination, animal and vegetable products, is the exclusion of oxygen. As the oxygen is generally afforded by the atmosphere or water, the immediate object to be gained is the entire exclusion of air and moisture. There are five methods in most extensive use:

1. By the use of salt.
2. By the use of sugar.
3. By the aid of heat.
4. By the use of creosote
5. By exclusion of air.

I. PRESERVATION BY THE USE OF SALT.

The action of salt in preservation is compound, being partly chemical and partly mechanical. It first draws out the moisture from the substance of the meat, making a brine which acts, secondly, as a separating medium from the air.

Salt—chloride of sodium—being composed of chlorine and sodium, and hence incapable, by any decomposition, of affording oxygen to the substance, possesses mainly the negative quality of inertness. It does not act upon animal fibre either to conserve or destroy, neither the chlorine nor sodium uniting with the

substance. Having, however, a great affinity for water, it absorbs and draws out from all substances with which it is in contact a large proportion of its fluid. The strength of this affinity is well illustrated in the common experiment of mixing salt with pounded ice, the salt thawing the ice in order to unite with it, though by so doing the temperature is carried down to — 40°, (or more than 70° below the freezing point) a temperature sufficiently low to freeze the fingers in a few seconds if placed within it even before a fire. This powerful affinity of salt for water enables it, when placed upon meat, to extract the fluids, which, combining with the salt, are prevented from acting again upon the substance. But not only are the fluids principally extracted and rendered inert, leaving the particles of the meat, so to say, *dry*, but the brine itself, if completely covering the substance, constitutes an impenetrable shield against the admission of air. The action of salt, simple as it appears, is thus twofold—first, that of extracting the moisture actually present in the fibre, and ready to initiate chemical combinations, and consequently decomposition; and secondly, of preventing, by the brine thus made, the re-absorption of moisture from the air.

This method of preserving animal substances, one of the most common and important, simple and yet effective, demands further examination, inasmuch as in ordinary practice it frequently fails to effect its purpose, or, in other words, the meat fails "to keep." There are three principal causes of this failure in preservation by salt:

First. Impurity of the salt.

Second. Impurities, or foreign substances in the water used for brine.

Third. Change of temperature.

The subject of temperature will be treated hereafter.

The impurities introduced in the water are as various as the soluble salts in the earth from which the water is taken. The most usual of these are, the salts of lime, iron, and potash. In colder latitudes, or when it is intended to preserve meat only through the winter, the impurities of ordinary well or spring water are not sufficient to produce any appreciable effect; but when articles are prepared for commerce, or for preservation through the summer, or in southern latitudes, a purer water is desirable, if not essential. Hard water differs from soft only in having some of these salts in solution. It would appear evident from this that the softer the water the more desirable; and as recent rain is the purest of natural waters, it is to be preferred for the purposes of brine, pickle, or any other preservative.

But the great point of importance in the preservation of animal substances by salt is the purity of the salt itself.

The chief sources of salt in the United States are the West India Islands, the Atlantic coast, the salt springs of New York and of the Ohio basin. The very material difference in the quality of the salt produced at these various localities arises both from the difference in the water used and from the manner of manufacture.

When sea water is entirely evaporated there will remain as a residuum all the materials which were held in solution. Many of these take a crystalline form so nearly resembling table salt, and so minute and intermixed, as to render separation impossible.

A hundred pounds of this mixed material contains about 75 pounds table salt, 5 pounds carbonate of lime, 2 pounds carbonate of magnesia, 3 pounds sulphate of lime, 7 pounds sulphate of magnesia, 8 pounds chlorate of magnesia.

Such a mixed salt is valuable only for agricultural purposes. For table use, and especially as a preservative, it is desirable that the chloride of sodium be nearly or quite pure. If all these various salts had an equal degree of solubility or affinity for water, then upon evaporation equal quantities of each would be thrown down; but if there be different degrees of solubility, then

that which has least affinity for water will be deposited first, and so on successively, till there will be left only that which has strongest affinity. As this is the case with these several salts, proceeding upon this basis, sea water is carried through a succession of vats or shallow tanks, remaining in the first until a certain degree of evaporation has been attained, whence being carried to a second, a certain higher degree is reached, and so on, one salt after another being precipitated in the different vats. By this means the chloride of sodium is crystallized nearly free from all other substances. In this mode of manufacture, which prevails along the Atlantic coast from Massachusetts to Florida, and which produces a salt of the finest quality, the water is carried in the vats in some instances a distance of twelve or fifteen miles. "One unacquainted with the business would be astonished at the quantity of impurities deposited from sea water by this plan. In strengthening from 6° to 12° Beaumé, the brine precipitates a gray, slimy mass, mixed with organic matter, and gives forth sulphuretted hydrogen. Further strengthening from 12° to 22° it precipitates crystalline sulphate of lime chiefly, and during this period bromine shows itself, especially if a little rain falls in the brine. This brings out the color to such a degree as to tinge various substances which come in contact with it. At 25° the brine stands at saturation."

In the West India Islands there is very little care in the manufacture; indeed, it may be said there is the greatest carelessness, so that the product of these works is always of very questionable purity. It is never to be relied upon for the purposes of preservation. Turk's Island gained its reputation half a century ago before these improved methods were in use on our seashore, and, with the proverbial slowness of tropical climates, follows still in the steps of the fathers.

"The fact is noteworthy that salt made from water of the Gulf Stream, which is used here, [Turk's Island,] is held to be of superior quality, though it is certain that in many places this salt is manufactured with the greatest carelessness.

"In Spain, Portugal, and their dependencies, the process for making salt is still very imperfect. The water is let directly into the pans or ponds from whence salt is raked without attempting to precipitate the impurities from the brine, or to hasten the period of raking by concentrating the evaporation of the whole works on a few of the last pans, in a series as above described, the superior dryness of the climate rendering this not absolutely necessary. In consequence of this, the common salt crytallizes in a half floating mass of impurities and brine, impregnated with iodine and bromine, which last substances give a disagreeable sharpness and acridness to the salt, so much complained of in England. Even the St. Ubes, which is somewhat better in quality, is manufactured with much the same carelessness.

"These countries are extensive but variable sources of supply of solar-made salt to the United States, we having imported from Spain, Portugal, and their islands, in 1856, 1,614,456 bushels."

At, Turk's Island, some of the Bahamas, St. Kitts, and St. Martin's, with a few of the British West India Islands, excellent salt is made at works where the French plan is carried out in part or in whole; but at many (probably a majority of the works on those islands) the same carelessness prevails as with the Spanish and Portuguese.

These examinations of sea salt render it apparent that little reliance is to be placed on the ordinary articles of importation. That made upon our own coast being in a less torrid climate, necessitates greater care, and hence furnishes a much superior article.

Let us now examine the salt of the springs. Of these the most important are the Onondaga, of New York.

Referring to the paragraph above, we see that, according to the salinometer of Beaumé, 6° to 12° saturation throws down "a gray, slimy mass," with sulphuretted hydrogen; from 12° to 22°, sulphate of lime. But while it requires 350 gallons of sea water to yield a bushel of salt, the Onondaga water yields a bushel from thirty to forty gallons, thus giving the Onondaga water, before any evaporation, a saturation of nearly or quite 20° Beaumé. This water has,

therefore, already passed the point beyond which it can hold in solution the greatest amount of impurities. Indeed, it can hold little else than chloride of sodium. Thus we have in this water the basis of nearly a pure salt, and it is probable that from it is manufactured one of the purest salts at present in use in this country. It is certain that only the greatest care in extraction can produce from sea water a salt of equal excellence.

This brief review of the subject of salt will fully explain the requisites for salting down any animal substance which is to be preserved for any considerable time, or to be exported to any warm climate.

II. PRESERVATION BY SUGAR.

The action of the sugar, though used mainly for the preservation of vegetable instead of animal products, is very similar to that just explained. Sugar in its crystalline state, like salt, has an affinity for water, but the affinity being considerably less, its preservative qualities are much less decided. Brought into contact with either meat or fruits, the moisture is drawn out to unite with the sugar, but while thus securing the material against decomposition, if it has absorbed considerable fluid, it may itself go into fermentation. If, however, the quantity of water is proportionally small, the sugar, holding it firmly, becomes like the brine, the impervious coating around the substance to be preserved.

This rationale suggests the cautions necessary in this mode of preservation. First. As the sugar can hold with permanency but a limited quantity of water, the sugar itself should be as exempt as possible from moisture, and as crystalline sugar has no capacity for water, while vegetable and animal substances always have water in composition, the sugar should not only possess the highest degree of crystallization, but be exempt from all extraneous matters. The harder, firmer, whiter, and cleaner, the greater the power of sugar to absorb water, and consequently to preserve.

Secondly. As sugar is not a very stable chemical element, having, when united with a portion of water, a tendency toward the vinous fermentation, especially when acted upon by heat, it is necessary that the preserve be kept at a uniform and low temperature.

Chemical action, when once commenced, can never be recovered. It may for a time be checked so as to be harmless, but the process of decomposition once commenced, like that of revolutions, "never goes backward." To bring the sugar more thoroughly in contact with its object, and to assist it in penetrating the inner parts of the vegetable fibre, and to drive off some portion of the water, ebullition is usually resorted to, the substance being boiled in sugar.

The quantity of sugar used, and the amount of boiling necessary to a thorough preservation, will, of course, vary with the juiciness of the fruit. There should be sugar enough and boiling enough to produce a thick, honey-like sirup, entirely covering the fruit.

III. PRESERVATION BY HEAT.

Few subjects of investigation have been attended with more interesting results within the few past years than that of *heat*. And as it underlies so great a portion of chemical changes it will repay us for one or two primary considerations.

Sound has long been known to be a vibration of the atmosphere transmitted from particle to particle, and thus borne abroad a certain distance. Now, in a manner similar to the universal diffusion of air around the earth, there is an exceedingly minute, subtile substance or medium called æther or ætheria pervading universal space as far as our knowledge of it extends, and in a similar manner does it transmit vibrations or oscillations. One of these vibrations

produces, or *is*, what we denominate *light*. So long as this vibration continues, and we are cognizant of it, we say it is light, and when it ceases, that it is dark. Sound and light are, therefore, *motion* of air and ætheria.

"Silence and darkness,
Twin sisters from eldest night,"

are *rest*. Another vibration of ætheria, differing somewhat from the first, yet closely allied to it, is *heat*. Thus when ætheria is motionless it is cold and dark; the instant it, from any cause, commences to vibrate, and we become cognizant of this motion, we say it is light, or warm, or both.

It is a further well-known fact of philosophy, that if the atmosphere be put into motion by the vibration of a tightened string, as a harp or piano string, it will transmit the vibrations or oscillations to any other string near. The analogy of this transmission through and by means of the particles of the atmosphere holds good in ætheria. A warm body being in a state of vibration transmits the vibration to all bodies within its influence. From this it results, that the sun, the great source of all light and heat, acting as a central energy, diffuses to the entire mass of matter within its influence a constant vibratory motion greater or less; and, secondly, that as heat is the disturbing cause in all chemical affinities, all chemical action is due to the variations, accumulations, or transmissions of this force.

But does this great comprehensive power cease its influence at chemical affinity? Or do we not find traces of it still higher in the scale of terrestrial development? Let us examine further.

A bottle of water placed beyond the influence of all disturbing causes and kept at an absolutely unvarying temperature is, so far as we know, perfectly motionless. Let now a ray of the sun or a ray of heat impinge upon it, and the particles are instantly put in motion. From a dead and immovable substance, without order or parts, it has become a moving body, and so far organized that it has position with the relations of *above* and *below*, with a vertical circulation established. Shall we say this is life in its most elementary exhibition?

Take a grain of wheat, removed from moisture and heat, and it will lie motionless for years. So far as we may know, it is dead. If it be moistened at the freezing point it will slowly decompose. No signs of life manifest themselves. Let now a ray of the sun or of heat fall upon it, and a new power is instantly apparent. The fluids within are put in motion and the wheat begins to grow, and we say it has *life*. The seed had within the principle of vegetable life, but it was motionless till the vibration of ætheria struck it and imparted to it its own motion and force.

Again, an egg, cold and still, is, philosophically, absolutely lifeless, dead. It has, within itself, not the slightest capability of motion. It is a germ, having, not the power of *moving*, but the power of *directing an impulse* when received; and this impulse, without which no motion could ever have occurred, is transmitted to it through this subtile agency, ætheria, and thus life is inaugurated. But whence this power by which life manifests itself? The force by which the motion was produced in the bottle of water is clearly nothing more than the force transmitted to the water by the heat, or that imparted to it by the vibrations of ætheria. Is the force of the grain of wheat or of the egg anything more? It would appear that the force of these vibrations received into the living body, being retained and put under the control of the will and mind, becomes what we denominate the animal powers or vital force.

Hence the imperative necessity of food. The animal is constantly exerting, that is, exhausting force, which must be met by an unfailing supply of calorific vibrations. Hence, also, why death occurs immediately, though there be no disease or lack of nutrition, if the body becomes cold, *i. e.*, if the vibrations that give it all its force once cease. Chemical action, vegetable and animal power appear, therefore, nothing more than the original vibratory force of heat

acting under different controlling agencies: in the first, in connexion with only chemical affinity; in the second, with chemical affinity controlled by vegetable life; and in animal existence, superadded to both, there is the law of animal life.

Nor is it probable that this great all-pervading force of the universe stops here. There is good reason for believing that every manifestation of physical force with which we are acquainted, every motion, every germination, every decay, every decomposition, every attraction and repulsion, whether in the silent laboratories of nature or in the hum of multitudinous enjoyment at summer evening, whether in the gambols of the myriad life that tenants a drop of water, or in the measureless wanderings of the comets—all are but parts of that great, one, universal, omnipresent power, whose manifestations we call light and heat.

Returning from these general considerations to the question directly before us—from this constitution of matter, it is apparent that any substance held in composition either by chemical or vital forces, will remain fixed till the particles of ætheria, being thrown into vibration, strike the particles of matter with a superior force, tending to carry them away from their present combination. In the case of the animal, as the composing force is chemical affinity and animal vital force united, both being opposed to the antagonistic vibrations of heat till equilibrium is produced, it follows that as soon as the vital force is removed or death occurs, the remaining composing force is overcome and decomposition must instantly follow.

If this preponderating force be proportionately diminished, the decay will be retarded, and if sufficiently diminished, wholly arrested. Thus, meat placed upon ice or wholly surrounded by ice, will, in summer, change slowly; if carried down several degrees below the freezing point, as in northern winters, it suffers no appreciable change. The preservation is attained in these cases by the abstraction of heat—the disturbing cause.

Upon this principle, also, are based nearly all our attempts at preservation, with whatever other aids conjoined. If the vibratory force of heat be continued, every effort at retention will fail. No substances gathered into combination against the disturbing influence of heat by the united power of chemical affinity and vital force, can retain its composition on the cessation of one of the forces, unless the opposing force be equally diminished. This general principle must be considered in every attempt at preservation.

But, contradictory as at the first glance it would appear, preservation is also accomplished by direct and energetic application of heat in excess. It might be inferred from the preceding exposition that this would induce and facilitate decomposition rather than effect preservation; and it would, indeed, were it not for the intervention of a mere accidental circumstance. Decomposition is carried on by means of the fluids in the substance. Dry solids seldom decompose with rapidity. If heat be applied to a vegetable or animal substance not having a large amount of fluids in composition, the moisture may be all rapidly dried away before any material change of constitution can have time to be wrought, and thus the body will become fixed by being dried to a solid. If the substance be too juicy or of too great thickness, while the outside is drying, the inside, not having its moisture reduced but its heat increased, will decompose—a condition often occurring in attempting to dry heavy pieces of beef and pork. The remedy here is very apparent: either to make the thickness less, to increase the evaporating surface by deep gashes, or to aid in the abstraction of moisture by salt.

But this means of preservation is more generally taken in connexion with some of the others, as an aid rather than as a sole reliance. In a few cases, where the substance is small, as berries, or can be reduced to pieces of considerable thinness, as apples, peaches, &c., it is sufficient for perfect preserva-

tion. But in many of these cases, even, it is the sugar in the fruit that is the final preservative—the water not being wholly removed, but only so reduced as to leave the sugar of sufficient strength to act as previously mentioned.

In the case of fruits, whether as a preserve or in sealed cans, the heat acts both to reduce the moisture and to permeate the substance with the sugar, and is therefore highly advantageous. In the case of dried meats, salt is first used to extract the moisture from within; then, being placed in a warm, dry atmosphere, it is sufficiently desiccated to render it inert to ordinary fluctuations of temperature and moisture.

IV. PRESERVATION BY CREOSOTE.

Besides these three more important agencies, there are certain active chemical substances which possess greater or less preservative power, particularly upon animal substances. The most of these, however, are too noxious to serve any useful purpose, or to be used without danger. The only one employed to any extent is creosote, a chemical substance obtained by the distillation of various vegetable substances, particularly wood, and which constitutes the active principle of smoke. Its action upon animal life is not well understood further than it serves to fix the particles in their present combination, and thus serves as a preservative. It is supposed that it acts through the nitrogen.

In respect to their sanitary qualities, preservatives may be classed as beneficial, inert, or injurious: salt and sugar being in the first class, heat in the second, and creosote, nitre, arsenic, &c., in the third. Of course, in using the substances of this third class, we must be guided not only by the consideration of preserving, but also of the reception of the preservative into the human system.

Arsenic, though possessing highly preservative qualities, is too active a poison, and attended with too much danger to permit its use in quantities that would serve any valuable purpose. Nitre is possessed of too little preservative power, and too active in the animal system to make its use valuable or desirable only as an occasional aid in other processes.

Creosote, since it is found in every household, and in a state of dilution, in smoke, that renders it harmless, has, from earliest times, been a favorite means of preserving animal substances. Care is necessary that the substance be not over-smoked. Salt and sugar are frequently both used in the preparatory pickle, thus combining three methods. There is little or no difference in the qualities of the creosote found in different kinds of smoke, but there are many additional gases in the smoke produced from different materials, all of which are liable to be absorbed to some extent, and thus injure the qualities and taste of the food. As bark contains the essential oils of the tree, its smoke is not so desirable as that of the wood. That of corncobs is, by many, esteemed very highly; but perhaps the sweetest and purest smoke is obtained from dry hickory sapwood without the bark.

If the process of smoking be too much hurried, the creosote will not have sufficient time to penetrate the entire substance. The outside will present every appearance of a perfect cure; but as warm weather approaches, decay will commence within. A thorough preservation by smoke can only be accomplished by ample time.

V. PRESERVATION BY EXCLUSION OF AIR.

The purpose in this method is to avoid the peculiar chemical changes wrought in food by the other methods, either that of salt, sugar, or creosote—*i. e.*, to preserve it in its natural state, or *fresh*. Too great a proportion of salt food results in a scorbutic tendency of the system; of sugar food, in a tendency to dyspepsia; of smoked, to both. To avoid these results, the effort has been

made to secure freedom from change without the use of these agencies. If, as has been stated above, the chemical change wrought in vegetable and animal substances arises chiefly from the union of oxygen with the substance, and the oxygen is supplied from the air or water, then it seems a fair conclusion that entire exclusion of both air and water, together with a low temperature, would affect the preservation. This general statement would be true were it not the case that the substances will absorb, in the brief time of putting up, sufficient moisture to inaugurate the process of decay. It will proceed slowly; but the rapidity is of no consequence, as the substance is valueless as a food as soon as decay has commenced.

It has been found that grape-juice, expressed under mercury, will remain permanent at moderate temperatures, no change taking place; but if it is once exposed to the atmosphere, even if it be but an instant, it gradually yields to chemical action. To counteract this absorption of oxygen, and to still further guard against these tendencies to decompose, it is necessary to remove some portion of the moisture naturally present in the body. This is done by heat. The boiling must be continued sufficiently to reduce very materially the water in combination. A small amount of salt—merely enough to season meats, and of sugar to render fruits agreeable, added—aid in the process by further absorption of water. While in the heated condition, it is placed in the vessel, *also heated,* and immediately sealed. If the process has been properly executed, the substances will remain unchanged at all usual temperatures of cellars or cool closets in the northern and middle United States. The points of failure in these processes are usually want of boiling and imperfect sealing, or closing of the cans or bottles. The vessels should be first placed in boiling water, and the sealing take place at once. *Not a particle of air should be left within.* The retention of a small amount of air in improperly made cans or stoppers is doubtless one of the great causes of frequent failure.

Tin vessels or cans are open to two objections: first, they are liable to corrosion by many of the acids in fruits; and, secondly, from their opacity it is impossible to ascertain by inspection whether the sealing has been perfect, so that it may be resealed, or, if not detected till some days after, selected for use as being less likely to keep.

Earthen or stone vessels are exempt from the first liability, but not from the latter. Glass, on the other hand, is free from both, but is more liable to fracture in filling. It is doubtful, however, if the cost of breakage is equal to the loss in the use of tin vessels. In view of all these considerations, glass seems the most desirable. The next important, and perhaps the most important, question is as to the stopper. Stoppers or covers made with rubber fittings, while having the advantage of dispensing with the sealing gum or wax, and being always in readiness, frequently impart an unpleasant taste and odor. This kind of stopper is popular just at the present time, from its great convenience; and in that quality is entitled to all the consideration that convenience can merit at the expense of excellence. A more objectionable cover still is that having its edges turned down, generally made to screw on, and to be sealed. This possesses a prime fault—that of holding a quantity of air under the cover, which it is nearly impossible to remove. Though put up properly in every respect, the air taken into the can under the cover is sufficient to warrant decay of eight cans in ten. The cover should always have the middle lower than the edge, and the under face smooth, so that when pressed down upon the contents of the jar, the middle will touch first, and thus leave it impossible for any air to remain within. If the edge is the lowest, or if there be any wrinkle or groove in the under face, small quantities of air will remain, despite every precaution. But perhaps one of the most economical and satisfactory of all the multitudes of jars and cans is the old, wide-mouthed glass bottle and cork. It has the requisites of cheapness, simplicity, dura-

bility, purity, of being as good a preserver as any other, and of allowing a constant inspection of the contents. Its chief drawback is, that wax in sealing the bottles is more troublesome than the patent rubber stopper.

Whatever stopper may be used, two points must be accomplished, and if they are successfully gained, the means employed are unimportant; these are, first, *entire expulsion of air*, and, second, *its permanent exclusion*. In the case of the glass jar and cork, the mouth should be from one to one and a half inches in diameter, the jar being heated slowly in water, and filled nearly to the top with the preserve; two pieces of strong wrapping twine are placed at right angles across the mouth, when the cork is inserted with the twine across its lower surface. Force the cork down upon the preserve till all the air is out *and the fluid comes out beside the twine*. Every particle of air must be driven out. Let another strong twine be tied over the cork and around the neck of the bottle, and trimming the ends closely, invert it and plunge the cork and neck completely beyond the twine into the melted wax, removing it quickly. Two or three insertions at intervals of half a minute will finish the work. It has been objected to this that the cork is not held in its place with sufficient force; that it is liable to be driven out by the force of the gases. It is sufficient answer to this, that when such a result ensues, it is quite time that the cork was driven out.

In concluding our observations upon the general nature of preservation, we cannot omit a passing remark upon one or two points in connexion. First. The difference in price of a large share of farm products between the best and poorer qualities arises in most cases more from the manner of preparation than it does from any original difference in the articles. A Mr. Gordon, of Boston, obtained for Bartlett pears ten dollars per bushel, while the same pear was selling by other dealers beside him at three dollars; this difference in price being due solely to Mr. Gordon's care in preparing for the market. So great a per cent. of improvement as this may be rare, but it will illustrate the point that it is not the simple material that gives it value, but its condition.

Second. The additional labor required to produce an article of first quality is little or no more than that required to produce an indifferent or low-priced one. Fruit must be gathered and packed and transported, whether it sells for much or little. Slight additional care in handling, packing, or ripening, effects the change in market value.

Third. This increase in price is the particular point of profit. By the natural laws of competition, of demand and supply, the great mass of market staples will always be salable at a small per cent. above the actual cost. To sell at the lowest general rates is simply to recover cost and allow no profit. To sell at fair prices is to make a small actual gain upon the actual outlay of time and strength. It is evident that a change of labor into fruit, merely to receive back just the value of the labor, is to accomplish nothing. To expend twelve cents in producing a pound of butter only to sell it for twelve cents is to make a sacrifice of strength and life. To sell it for thirteen cents is to gain one cent. In this exchange it is not the twelve cents, but the one we are laboring to receive. In that transaction we gain eight per cent. on the capital invested. To sell it at fourteen cents is to make a gain of sixteen per cent.; at fifteen, twenty-four per cent. This is but a common case. It is within the observation of every one that while the general rate for a common article of butter may be twelve or fifteen cents, there are always certain dairies or brands of butter selling at sixteen to twenty-five cents. Now, as twenty-five cent butter costs the producer little or no more than the twelve cent does, here is a clear profit of fifty to one hundred per cent., at the same time that others are realizing but eight or ten per cent. in advance.

Fourth. Neatness and niceness are among the best investments food producers can make. Good qualities, slovenly arranged, must always pass at

second rates; while second qualities, if but neatly and invitingly displayed, usually go up to the higher figures; and this, it should be recollected, is clear profit.

APPLES.

It hardly need be stated that fruit intended to be kept for a time should be primarily sound. Apples should not, therefore, be shaken off the tree, nor be permitted to fall naturally, but be carefully plucked by the hand. The bruises they receive in falling against the limbs of the tree, or upon the ground, induce early decay. For the same reason they should not be allowed to drop heavily into barrels or bins. Careful handling is a material element in keeping fruit of all kinds. Barrels are not the best receptacles for apples for the winter. They are apt to "sweat," and, pressing heavily one upon another, decay is readily communicated; at the same time it is inconvenient ascertaining whether they are keeping well or not. It diminishes the chances of decay by contact to separate each layer by a layer of leaves or oat chaff; but the best means of preservation is believed to be placing them upon open shelves at a distance of one to three feet from the cellar floor, or as near the floor as possible without dampness. They decay less, are not liable to "sweat," and can easily be inspected for the purpose of removing the imperfect ones.

FOR MARKET.

There is frequently a great per cent. loss by decay in apples sent forward to market. The manner of packing is of comparatively little consequence when the fruit has to be transported but a few miles, but when a distance of some hundreds intervenes the durability of the fruit is the great consideration. First, as to the fruit itself, it should be picked from the tree by hand, and carefully placed in the barrels, (not poured in,) being packed closely and tightly. The barrel should be clean, and, particularly if a flour barrel, thoroughly washed and scrubbed with a broom till not only the loose flour is removed, but *all* the flour. If any remains, in the jostling of carts or cars it scatters among the apples, and, adhering to the moist surface, soon moulds and decays, setting up general decomposition throughout. A flour barrel, unless thoroughly free from flour, is one of the most undesirable receptacles for fruit or vegetables of any kind. The barrels and the apples should both be perfectly dry when packed; afterwards the barrel should be left open till the immediate time of removal. It should be so completely filled and tightly packed that, when the head is pressed in, there shall be no motion of the apples on one another as the barrel is rolled along or turned upon end.

DRIED APPLES.

As success in this case depends solely upon evaporation, nothing more is requisite than to secure the greatest amount of sunlight upon the greatest extent of surface. To secure the first, the table or scaffold upon which the apple is to be spread should not be level, but inclined toward the south at an angle of 10° or 15°, so as to present more fully to the sun. The second point is gained by removing the skin and cutting into slices, the thinner the more expeditious the result. The drying is facilitated by moving the pieces about several times during the day, so as to expose them more freely to the air and sun. They should be taken in some time before sunset, as at that season the dews fall early.

APPLES IN CANS

should be boiled about fifteen minutes, if very juicy half an hour, with a small amount of sugar. If the cans are such as previously indicated, and the

sealing perfect, the fruit will keep till late spring or early summer. Best kept on the cellar floor on account of its cool and uniform temperature. It is better not to handle or move the cans until taken for use.

APPLE SAUCE OR BUTTER.

The preservation here is concentrated cider. Unfermented or new cider boiled down six gallons to one becomes unsusceptible to fermentation at ordinary temperature, and, as it now parts with its water only with difficulty, it becomes a good preservative at low temperatures. Apple and a small proportion of quince, boiled sufficiently to discharge its finest moisture, placed in the sirup, keep well till late spring, making one of our most substantial fruit sauces.

BEANS.

This valuable crop has few superiors in durability. Having a small per cent. of water in the body of the grain, and being covered with a hard glazed pellicle, it absorbs little or no moisture, and decays very slightly with the lapse of months. But the original drying must be thorough and complete. The very hardness and imperviousness of the pellicle preventing ready transmission, the process of drying will not be rapid. Exposure to a current of air for some days, even after they are housed, serves to continue the evaporation and complete the drying and hardening. When once they are thoroughly dried, placed in an airy upper room, they remain almost unchanged many months or years.

BEEF.

At moderate temperatures exposure to a dry current of cool air will preserve fresh beef quite as long as it can be kept in an ice chest. The dry air carrying off the moisture from the surface, and thus cooling the meat from both these causes, checks decay. The most convenient arrangement is to suspend the meat in a north, open window, another window or door being open so as to create a draught of air. It should not lie in a dish, as the under side will be prevented from drying. When meat is placed in an ice chest, as from the nature of the case abundant moisture is afforded, reliance is placed solely upon the low temperature. If moisture is present, no temperature greater than the freezing point can wholly prevent decomposition. Meat, therefore, once placed upon ice prepares itself to decay at that temperature, and, if removed, spoils quickly. This fact should be understood by those who purchase fresh meat in market. If the meat has once been in the marketman's ice chest, after being carried home on a hot summer morning, it will hardly keep sweet three hours, whether it be on ice or not. It is a serious error to suppose ice-kept meat, because no odor from it can be detected, is the same as fresh-killed meat. Chemical action has been hindered by the temperature, but it is so prepared that it only needs an elevation of a few degrees to run into rapid decay.

DRIED OR JERKED.

In the dry, cooler latitudes of the northern United States this mode may be successfully practiced in almost any season, but usually only in the cooler. For *jerking*, if the weather be fine and the exposure to wind favorable, little salt may be required; but for large and heavy rounds, as is usual, other means are needed to assist. One of the most common is to rub the meat thoroughly with hot salt. It is thought the heat enables the salt to strike in more readily. To meet with success great care is necessary that the salt be rubbed over every part of the surface, and into every crevice where air may penetrate. This should be repeated once or twice daily for three or four days. Unless

the weather is quite cool success will not be certain with heavy pieces. A surer and less inconvenient method is to place the meat in an ordinary beef pickle until it has had time to become thoroughly salted through, say from ten to fifteen days, according to size. It is then hung where dry air may have free access. Care is to be used that it be kept cool, or but moderately warm, while it is drying, otherwise decomposition may commence in the interior.

SALTED.

There is little difficulty in keeping salt beef in an ordinary farm cellar through the summer, but it is quite otherwise when prepared for market or transportation. If salted sufficiently to secure it against changes of temperature, it becomes so salt and hard as to be comparatively unpalatable and worthless. Of this nature must necessarily be "army beef," flatteringly designated by "the boys" "salt horse!" Army beef must be guaranteed against spoiling in all places and under all circumstances and temperatures, while farmers' beef is to be kept out of the sun at a cool, even temperature. The question with the farmer is not *whether* he can keep beef by salting, but *how* to salt it so as not to cause the loss of its qualities. In the first place, the cask itself should be perfectly sweet. If meat has ever once "taken hurt," it is quite impossible ever to render it safe again. Secondly, the winter pickle should never be retained for summer. As warm weather comes on, a new, clean brine should be substituted.

The materials and proportion for the pickle vary much in different localities, and according to the tastes of individuals. The following is substantially good: Make the pickle of strength to bear a fresh egg above the surface to the size of a quarter of a dollar; add one ounce of saltpetre to fifteen to twenty pounds of meat; one pound of sugar, or one and a half pints molasses in same proportion, if desired. After the meat is packed in the barrel, the pickle is turned on boiling hot. The spring pickle is of similar proportions, except being without saltpetre and without being heated.

BLACKBERRIES.

This very valuable berry forms quite a considerable article of food and market trade in the southern and middle States. When fully ripe or slightly overripe, the berry is apt to be broken in taking to market, in which condition, especially if the fruit was gathered when wet, it is very apt to sour. Berries in this condition, even if not sour, should be immediately rinsed by gently pouring water upon them in a cullender or basket and drying them in the sun. This will check the tendency to decay.

For preserving in cans, good sound berries that have not been wet nor soured should be selected. Boil gently ten or fifteen minutes, with sugar sufficient to sweeten. This berry, being small and juicy, may be put up in any ordinary mouthed bottle, and sealed as before mentioned.

For drying, the berries should be mixed four pounds to one of sugar, boiled gently a few minutes, then spread thin on plates and dried around the fire or in a slow oven.

BUTTER.

There is not within the whole range of agriculture so large a product liable to so large a per cent. of depreciation as butter. The amount of the butter crop of the United States is estimated at $65,000,000. Of this it may be said one-half might be sold for three cents more per pound. At the present time scarcely one firkin in four opens perfectly sweet. This deterioration arises not from any real chemical or practical difficulty, but solely from want of knowledge or want of care in its manufacture.

Butter is mostly an oil so well fixed that it is quite unsusceptible of chemical change. Cream is a peculiar mixture of this oil and certain watery fluids found in the milk. Churning consists in so agitating the cream as to cause the butter globules to adhere to each other. Now, as the principal part of the butter is not exposed to decay, it becomes a fair subject of inquiry, what is the cause of so large a per cent. of butter losing its sweetness so soon.

1. Milk being of itself one of the most perishable of animal products, its decomposition may have gone so far before the removal of the cream as to contaminate the fluids of the cream; and if so, then the butter, when first made, has already within it putrescent material which will soon infect the whole.

2. Even if the cream were entirely sweet, the milk remaining in the butter will soon decay, and if not removed will, of course, deteriorate the butter. The practical questions, then, are, when to remove the cream and how to free the butter from the butter-milk.

As to the first, it is desirable to allow the milk to stand as long as possible, in order to secure all the cream; but in doing this, there is risk of spoiling the whole. The real decay of the milk is indicated, not by its thickening as it sours, but by the watery effusion following the thickening. The cream may remain till this thickening process is complete, without exposure to the butter, *but not longer*. The cream should not, for the same reason, be kept too long after being removed before churning.

The processes of churning and dressing or working the butter are as various and valuable as there are intelligent and careful housewives; but in every successful method there must be one essential—the *thorough removal of the butter-milk*. To accomplish this, some recommend two or three washings of the butter in cold water till the water brings away no butter-milk, whilst others rely upon thorough workings. But whatever method is used, the removal of the butter-milk is a *sine qua non*.

As the milk is warm in the process of churning, the first requisite of the butter on being removed is to be cooled. A small amount of salt may be worked in with as little stirring as possible, and then it should be placed where it will cool rapidly. After a few hours it is worked, adding as much salt as may be needed to prepare it for market. Care should be taken that the salt be pure and good. A little more than an ounce per pound is sufficient. Five or six hours after, the butter is to be worked again; the manner of working being to press with a ladle or butter scoop, not to cut it through nor spat it, the most common method and the poorest of all.

For keeping for family use, stone jars are unquestionably the best. For packing for market a new tub should never be used till it has been thoroughly saturated with a strong brine. Cover the bottom of the tub with a thin sprinkling of salt, and pack solid; and, placing a cloth over the top, sprinkle on a thick layer of salt, pouring on a gill of water to form an air-tight covering of brine. When it is to be sent forward to market, the brine should be poured off and a new coating of salt laid on.

CHEESE.

The process of preserving cheese is so simple and so effectual that it scarcely demands attention here. Casein or curd being chemically quite passive, if the water be forced from it by strong pressure, and it is permitted to dry thoroughly, will become unsusceptible to ordinary atmospheric influences. When it has become quite dry it is protected both from moisture and insects by being enclosed in a tight-fitting covering of muslin rubbed over with oil or fat.

In butter, the value depends upon the manner of its manufacture; in cheese, upon the material also. Good butter more especially commends the housewife; good cheese, the cow.

COTTAGE CHEESE, OR SMEAR-CASE.

Pour over a crock or pan of thick milk sufficient boiling water to cover the surface; let it stand half an hour in a warm place or until the whey begins to separate, then pour it into a thin muslin bag and hang it up in as cold a place as possible without freezing, until the water and whey are strained off. In winter this cheese can be kept from one day to the next; but in summer it spoils before the next meal. The milk must be thick, but not old. If left standing until the whey separates from the curd before scalding, the cheese will be stale. The milk should not be stirred before scalding.

CABBAGE.

Cabbage is easily kept, though liable to wilt and to imbibe a disagreeable taste if the air of the cellar be impure. For home use, keeping it in the ground has the advantage of preserving its freshness and purity. The most convenient mode of doing this is to make a trench the width of a spade and a foot in depth, into which, inverting the plant and wrapping the leaves closely, the heads are to be placed, leaving the stalks above ground. A little straw being thrown over, they are covered to the depth of four to six inches. For market they should not be packed in close barrels. Apertures should be made sufficient to allow circulation of air.

SAUER KRAUT.

The cabbage being gathered in October, before it has had too much frost, is cut nearly as fine as for cole-slaw. A layer to the depth of six inches being put into the barrel, a little salt is sprinkled upon it, and then it is beaten with a heavy stamper until it becomes juicy or nearly a pulp. Each layer is to be treated in the same manner. When the vessel is full, some leaves of cabbage are first put on the top, then a board fitting not too closely, and weights placed upon it so that it may be well pressed. In the course of a week the scum that rises to the top should be removed. Remaining from four to six weeks undisturbed, it is fit for use. The vessel should not be used for any other purpose, and each year thoroughly cleaned, so as to be free from any odor. The best place for keeping it is a cool cellar, but not so cold as to freeze.

CORN.

The analysis of corn, showing a per cent. of water from twelve to twenty, readily indicates its most salient point. So large a per cent. of water in its composition renders it peculiarly liable to fermentation. The hard, silicious, or glassy pellicle, however, affords the kernel very complete protection while on the cob. The most exposed portion of the kernel being the eye, or where it is affixed, we should infer that it is better not to remove it from the cob till it is required for use. The great point in the preservation of corn is its complete dryness and its constant exposure to the free air. The out-door granary is one of the best means that can be devised for affording a constant admission of air, but is open to the objection of not securing sufficient protection against dampness. Spreading upon a floor in a room that may be closed secures the latter point, but does not allow equal freedom of air. Abundance of air is the great guarantee of corn.

CHERRIES.

Cherries having in composition an abundance of juice, decay arises not so much from external moisture as from air and heat. They are, therefore, best kept as a fresh fruit by being placed in an ice chest with little exposure to air.

If the skin is not broken, and particularly if the stem is firmly set, they may be kept for several days. Cherries may be dried either in the sun or in a slow oven, having first been boiled a few minutes with one-fourth weight of sugar. In this, as in the following method, the stones should be removed. For preserving in cans, add half weight of sugar, heat slowly till it is melted, then boil briskly for fifteen minutes. In the mean time heat the cans in water up to boiling, and put the fruit into the cans while in the heated water and seal immediately.

CURRANTS.

This fruit, from the large size of its seeds, compared with the berry, is not so desirable as a can preserve or as a jam. It is, however, one of the most valuable of garden products for jelly and wine, which, in addition to their edible excellence, hold a high place in the materia medica. Currants, to be dried in the sun, should, like apples, have a good southern exposure, with free access of air. The only care needed is that the drying be thorough. Another method of drying is to boil with one-fourth weight of sugar for about half an hour to an hour, then spread on plates, and dry in the sun or in a slow oven. For cans the flavor is improved by adding one-half weight of raisins. The strength of the acids in currants renders the use of tin cans objectionable.

CRANBERRIES.

The causes which operate to the disadvantage of this fruit are peculiar to it alone. Being of a cold and aqueous nature and growth, the early frosts of the higher latitudes come close upon the ripening. Indeed, every few years the entire crop is cut off by frost. This liability necessitates the gathering of them at the earliest allowable moment. When the harvest is effected, some consequently will be found unripe, while others are frost bitten. The frost does not seriously injure the fruit for immediate use, but renders the berry soft and pulpy, and so both unfits it for packing and prepares it for speedy decay. For home use, spread upon a floor in a cool, but not freezing, temperature, they will remain many weeks. For shipping they are put in barrels, which are afterwards filled with water. They thus make the voyage to Europe, the south, and even to the West Indies, in good condition. Cranberries may be preserved perfect for several years merely by drying them a little in the sun, and then packing them closely in clean bottles. These berries are of great value and importance for different well-known culinary purposes. They are of an astringent quality, and are esteemed good to restore the appetite.

CIDER.

Cider is deteriorated, both from want of care of the fruit, and from impurity of the cask. If the apples are permitted to remain till there is considerable decay, the taste of decay will be transmitted through all the fermentations of the juice. A pure, sweet taste can only be derived from sound fruit; secondly, sufficient care is seldom used as to the cask. Fresh liquor casks are the most desirable. A good mode of treatment for other casks is the following: Soak for one or two days, then rinsing thoroughly, put in one or two buckets of water with a couple of tablespoonfuls of saleratus. Cork tight, and let remain, with occasional shaking, for twenty-four hours; turn off the saleratus water, and fill immediately with cider. As the fermentation takes place, the object is to cork the cask tightly as soon as the pressure will not endanger it. This is a nice point of observation with each barrel. If it be strongly iron-bound, it will bear closing much earlier, thus keeping the cider sweeter and more lively through its entire drawing. The preservation of cider in this condition consists in checking by pressure the first fermentation before it is fully complete, and

thus preventing the second. The cask should be completely air-tight, as any leakage will allow the change to proceed. If bottled at this stage, it will remain indefinitely without change.

BOILED CIDER.

The boiling should be conducted with care over a slow fire, to prevent burning and giving an unpleasant taste, and be continued till six gallons are reduced to one. The sirup thus made, being inert at ordinary temperatures, becomes an important preservative aid.

EGGS.

The changes which eggs undergo, arising chiefly, if not wholly, from absorption of air through the shell, the means of preservation must be similar to those we have seen necessary in so many other instances. To accomplish exclusion of air, some pack the eggs in corn meal, others in lime water, others in brine. These last two methods are effectual for a considerable time, but the most successful means is to cover the egg with fat or oil or butter. Thus prepared, a newly-laid egg will remain six months without perceptible change.

FLOUR.

In reference to this most important of all our agricultural products—a subject which, in itself, demands more space than we shall claim for our entire article—we could say nothing more to the purpose, nor in less space, than is communicated to us in the following letter from the proprietors of the Brandywine Mills, Wilmington, Delaware, long known as producing one of the first grades of flour in the American market:

"In reply to your circular respecting the best methods of preserving wheat flour, we may remark that it is very difficult to have any general rule for keeping flour sweet, though there may be several plans adopted that will *assist* in doing so. The only certain plan that we know of is 'Tyson's patent,' which was used in Baltimore many years ago. This extracted all the moisture by *kiln-drying the flour*, after which it kept sweet in hot climates for one or more years. The process, however, is too expensive for general use. A great deal depends on the care bestowed on the wheat before reaching the hands of the miller. It is frequently left out in the fields for weeks after harvest, subject to drenching rains; it is also frequently housed or stacked in a damp state. Either of these causes is injurious to the keeping properties of flour. And we believe if farmers were more careful to keep their wheat dry, not only at the time of harvest, but subsequently, until it reaches the miller's hands, the flour would keep sweet much longer. It seems to be pretty well ascertained that the bran or hull of the wheat sours first. High grades of flour that have all the bran or nearly all extracted keep best.

"If the wheat is perfectly dry when put into a bin or garner, it will keep a long while without heating; it will, however, keep much longer in a bin where a current of fresh air is admitted than where it is perfectly close.

"Second. 'As to the vessel used for flour,' we have had no experience, except with the ordinary flour barrel. The best are made of oak, either white or red, made in the usual way of perfectly seasoned stuff. The moisture from green wood has a very injurious effect on the keeping properties of flour.

"Third. 'Of the building or room used for storing.' We believe from our experience that flour keeps better in a cool, dry, airy room than anywhere else. During the heat of summer, flour should not be stored either in a cellar or garret, but in central stories of a building, kept open so as to have a free circulation of fresh air among the flour.

"Fourth. 'Of any other special requirements, precautions, or peculiarities, necessary to perfect preservation.' We may observe that it is very important to keep the flour from exposure to hot sun or to wet. If shipped to distant ports, even in the United States, great care should be observed with regard to the vessel and other kinds of cargo; the hold should be dry and well ventilated during the voyage. If stowed with corn or oats that become heated, the flour will also heat and sour. Many other articles have this effect on flour. We have had flour soured on a voyage to Boston by being stowed in contact with some deleterious article.

"This is a very important subject—one that has claimed our attention for many years, and we regret we cannot give you more valuable information."

RYE FLOUR AND BUCKWHEAT FLOUR.

The general properties of these, as compared with wheat, are a larger amount of water in composition, and a greater quantity of bran, and hence a greater tendency to decay. The cautions are, therefore, the same as those for wheat flour, only with this difference: that while the latter may, with care, be kept some months, the former, except under the most favorable circumstances of cold and dryness, lose some of their excellence in a few weeks.

FISH.

Taken as a class, fish possess preservative qualities peculiarly their own, and require, in consequence, a corresponding treatment. The flesh of fish seems to be less compacted and less firmly held together than that of land animals in general, and is, as a result, less able to resist chemical action. Exclusion from the air being their natural condition, a more rapid action ensues upon exposure at ordinary temperatures, while upon ice decay is much less rapid. Many kinds of fish, as cod and halibut, are preserved by the fisherman, so that there is no occasion for a practical knowledge among the community at large; while, on the other hand, the extensive use of shad and herring along our large Atlantic streams, and of lake fish along the great lakes and their tributaries, taken fresh from the streams to the country, renders it desirable that the general principles of preserving this excellent article of food should be somewhat understood.

HERRING.

The inspectors of fish at Gloucester, Massachusetts, give the following directions:

"If dressed *immediately* after being caught, herring can be preserved from November to April by being packed edgewise into tight casks with a half bushel of coarse salt, and pickled. If to be kept through the warm season, the pickle should be drawn off by perforating the cask and letting it thus remain. The store-room should be cool and dry, and protected from the sun and warm air."

SHAD AND LAKE WHITE FISH.

If immediately dressed and packed in ice, these and many other kinds of fish, as halibut, mackerel, haddock, and salmon, will remain from six to fifteen days entirely sweet. The preservation by salt is simple, as all fish require a saturated solution of salt, *i. e.*, such a quantity as always to have a quart or two of salt remaining in the vessel. The fish should be kept entirely under the brine, and in a cool room.

GRAPES.

As the cultivation and use of the grape is becoming daily of greater interest to the people of this country, the modes of retaining as long as possible this excellent fruit in its freshness possess a corresponding interest. So much has been said, however, in former reports, that we shall merely advert to some of the most important points. In gathering grapes care should be taken that they are perfectly dry. They should be taken off in clusters, handled tenderly, and all unripe, immature, decayed, or injured berries removed, as well as projecting and surplus portions of the stem.

They are packed in layers in boxes, having a paper over the bottom of the box, a paper between each layer, and one over the top. The bunches are not to be crowded, nor left so loose as to slide about the box when being moved. For market the boxes contain about fifty pounds; for keeping for future use about ten pounds. The boxes should be put in a cool, dry place, free from

the sun, and at as even a temperature as possible, and kept closed until opened for use. Cotton has been used instead of paper for packing, but paper is found to answer every requisite. Thus treated, grapes may be kept till the approach of the warm influences of spring.

Put up in sealed cans, with half weight of sugar, grapes keep well throughout the year. Considerable boiling renders the preservation more secure.

GOOSEBERRIES.

This fruit is so nearly allied to the currant in size and qualities that it may be subjected to the same treatment.

HAMS.

In the curing of hams we have a new element against which attention is particularly to be directed—insects. Care has to be taken in all fresh meats against this annoyance, but there is no species of food for which insects seem to have so decided a preference as hams. The pickle for hams may be made in the same manner and of the same proportions as that for beef, only that it should not be used hot, as in the case of beef. Sugar or molasses may be added to this pickle as fancy indicates. The time of remaining in the pickle will depend upon the size of the ham—from one to two months—when it is to be smoked until the curative process is complete. This can only be determined by the amount of pickling it has received. As the preservation is accomplished by the joint effect of two processes one must respond to the other; if one has been deficient, the other must make good the loss. After the preservation is supposed to be complete, the usual, perhaps the most effectual, guarantee against insects is to sew the hams up in close sacks and cover them with a solution of lime or whitewash. This also serves as a covering to exclude the air.

HEAD CHEESE.

The more gelatinous portions of the slaughtered pork, such as the head, ears, and feet, being boiled until reduced to the consistence of a jelly, and being seasoned highly with salt, pepper, and spices, and pressed into a solid mass, will remain during the cool weather without change. This is, perhaps, one of the most satisfactory modes of disposing of the odds and ends.

HUCKLEBERRIES.

This very excellent little berry cannot be long kept in its fresh condition. In an ice chest it may be preserved a few days. The smallness of the berry renders it favorable for sun drying—a process so simple in these small berries as to need no remark. They are not much used as a preserve otherwise.

JAMS.

The preserve made from raspberries, huckleberries, blackberries, and other similar berries and fruits, which passes under the name of *jam*, differs from the common sugar preserve more in name than in fact. The berries are mixed with about an equal weight of sugar, and boiled or stewed, and *jammed* or mashed at the same time till the whole has the consistence of thick sirup. As so large a per cent. of sugar is used in the preparation, absolute exclusion of air is not requisite; and hence a paper cut the size of the mouth of the jar, and wet with brandy, laid directly upon the jam, and another piece of paper pasted over the mouth, are found to answer every purpose.

JELLIES.

If, instead of stewing the entire fruit, as in making jam, the juices be pressed out through a strong piece of coarse muslin, we shall have the pulp

without the seed or woody fibre. For this reason jellies are much more valuable for the household than jams, as being among the choicest stores for the sick chamber that can be secured. The preparation and mode of preservation are the same as those of jams. Apple, currant, grape, blackberry, and raspberry, are among the most valuable jellies.

LARD.

Being almost a pure oil, and the oils having a quite permanent composition, its preservation is very simple. Water having no affinity for oil, moisture has little or no effect, while air is nearly as powerless. In the reduction of lard from the tissues in which it is contained some particles of animal fibre are intermixed, which would, if exposed to air, yield to decay; but being surrounded by the oil and wholly enclosed they are kept inactive. Yet, after some time, if abundant, they may give an odor and taste of decay. This suggests that care should be exercised as to the purity of lard designed to be kept, as well as to the exclusion of the air from the vessel. Stone jars (not earthen) are the most desirable vessels. The room should be cool and dry.

MILK.

The subject of milk, and the best mode of its preservation, will be found fully discussed in the article upon milk in last year's Agricultural Report, from which we take the following, both from its importance and for the benefit of those who may not have that volume at hand:

"PRESERVATION BY COLD AND QUIET.

"This is the process practiced by dairymen generally, who are compelled to send their milk to market by the cars, and is given in by one of the most experienced milkmen dealing with the New York market. The process consists in cooling the milk to about 40° Fahrenheit as soon as possible after milking, and keeping it at that temperature, in perfect quiet, till it is ready to be carried to the cars. The chief requisite is a spring of cold water or ice. The quantity of water is not of so much consequence as its degree of coldness and its permanency. The water should be conducted underground the shortest possible distance to a suitable place for the location of the milk-house. This place, if possible, should be on the north side of a hill, well shaded, and so situated that the water from the tank will readily flow off. The house should be of such size and form as to admit of a tank two feet wide, and of sufficient length to hold all the milk cans. The depth of the tank should be about four inches less than the depth of the can. Each can should have a separate division, and the division so arranged that the water may pass from one to another.

"The tank should be so arranged as to be out of the way of any currents of air. The ventilation of the house should be only sufficient to keep the air pure. Most milk-houses admit altogether too much air. In all cases ingress of air to the house should be prevented as soon as a thunder shower is seen rising, and no admittance allowed till the milk is to be removed. In clear or in rainy weather the ventilator may be open, but never in showery weather.

"Ozone, which is freely generated by electricity, acts energetically on milk, souring it in a few minutes, many times destroying the milk before the shower has passed over. Therefore, all air from the vicinity of thunder showers, which always contain ozone, should be carefully excluded from the milk-house.

"Having prepared a place for the reception of the milk, its treatment remains to be considered. The cows are milked in the cool of the evening, just after sunset, and the milk is strained into the cans which are to convey it to market. These cans hold about forty quarts, and, when filled, weigh about one hundred and twenty pounds. They are made of strong tin, and are well bound. As fast as the cans are filled they are placed in the tank. The cans remain uncovered, and the milk is not allowed to be stirred, or even jarred. The tank should be so constructed as to be disconnected with the building. It should rest flat on the ground, so that any jar of the building cannot disturb the milk in the tank.

"In the morning the cows are milked before sunrise, and the milk placed in the cans as before. If there is a can partly full of night's milk, it must remain so; the warm morning's milk must not be mixed with the cool night's, but kept separate. In no case must a can of morning's milk stand in the tank above a night's can; for in that case the warmth of the morning's can will be distributed over the night's milk, and the process of souring initiated.

"At about three or four o'clock in the afternoon the milk is to be carried to the cars. The cans are then to be filled, if necessary. The milk being all cool can be mixed; in fact,

there is no difference between the night's and morning's milk. No parts of cans are to be sent to market, but to be *kept over twenty-four hours longer.*

"The cans are then placed in a wagon, and a wet covering spread over them, over which are thrown buffalo robes or other covering. At the railroad station the cans are closely packed in a closed car without anything being thrown over them, and during the night reach New York. The cans are then taken by milk carts, and the milk is distributed to consumers. The milk does not, therefore, leave the cans till it is sold, and generally it is disposed of at a temperature nearly as low as it left the milk-house. In this condition it will keep sweet twenty-four or even thirty-six hours, and is a pure country milk, quite different in value from that peddled at a smoking temperature of 70 or 80 degrees.

"A similar process of cooling has been practiced several years. It has been thought necessary to stir it several times while in the tank, to aid in cooling; but it is now, however, found that this treatment is highly injurious. The milk should be kept as still as possible till cooled to about 40° Fahrenheit or below, when it may be stirred or transported to a great distance without injury, provided the temperature is not elevated.

"This process is available and practicable for all milkmen. The milk should be cool in all cases before carting. Milk that is not cooled commences decay in a few hours after milking, and is not a healthy diet. Sour milk is not so injurious. It is milk that is in a state of change that is unhealthy.

"The plain suggestion, then, is, *to have the milk cooled before it is offered for sale.* Milk in the evening and peddle it in the morning, and sell the morning's milk in the afternoon."

This process indicates the method of preserving milk for home uses.

OYSTERS,

in shell, may be kept a few days in a cool, damp place, especially if some salted water be sprinkled upon them two or three times a day. As soon as the shells open they are no longer good. Removed from the shells and immediately put into cans or kegs, and sealed or corked perfectly tight, they may be kept sweet in the coldest weather several weeks.

PICKLED.

A most excellent mode of preservation is by pickling. Taken from the shell, they are simmered in their own liquor until they are white and plump. Being removed and cooled, they are carefully packed in the jar in layers, with a large sprinkling of pepper, spice, &c. The jar is then filled with equal parts of the oyster liquor and good cider vinegar; common merchantable vinegar will often consume the oysters. Sealed tight, they keep for months.

PORK.

Having so large a per cent. of fat, and holding in combination so little water that it does not, by absorption, become oversalt, pork presents the readiest facilities for preservation. It should not be put down till the animal heat has fully passed off, and it is cold throughout. When packed, with from forty to fifty pounds of salt to the hundred of pork, interspersed between the layers, and the barrel filled with soft water so as to fully cover the meat, and left in a cool place, no further care need be taken, except that it must be kept covered with brine. In the colder latitudes it may be kept fresh all winter by being packed in a barrel with snow, or suspended on the north side of a building. Freezing results in no material injury to its qualities.

PUMPKINS.

Decay naturally takes place in the pumpkin soon after the coming of cold weather. Placed on a shelf where they will be exposed to the cool air, but not exposed to frost, they remain some weeks without material change. Boiled until reduced to a pulp, and the moisture mostly evaporated, and dried in a slow oven until it is quite hard, it keeps well in a closely covered jar. Pared and cut into thin slips, it may be dried in the sun. The strips must be quite thin, the sun clear, and the atmosphere quite dry, to prevent moulding or souring in the process. Pumpkin may also be put up in cans, but success

requires more care than in fruits. There being a very limited amount of sugar in pumpkin, it is deprived of the preservative influence of that substance, as occurs in fruits. The boiling must be continued until the moisture is mostly driven off, and the pulp is quite dry. As much sugar added as the taste will allow greatly promotes security.

PICKLES.

The first requisite of pickling is a pure vinegar. Success with the common market vinegars, made of oil of vitriol, acetic acid, or similar chemical materials, is out of the question. Having a good vinegar, almost any tasteless, tender vegetable or fruit may be used for pickling. Thus we have green or unripe grapes, apples, butternuts, tomatos, peppers, cucumbers, melons, and, in fact, a nameless multitude of others. In all these cases the general principle is the same, *i. e.*, if the substance possesses any bitter or acrid principle, soak or boil it in water or brine until it is removed. After this nothing remains but to immerse it in a pure cider vinegar with condiments to suit. The ordinary mode of greening pickles by the use of copperas is highly pernicious, from the irritative and poisonous effects of the copperas in the stomach.

PEARS.

With very few exceptions this fruit should be picked before it is perfectly matured. The house-ripened pear is generally infinitely superior to that which is allowed to hang too long upon the tree. The fruit should be fully grown and beginning to ripen when plucked, else it will wilt and be insipid. A good rule is derived from the easy separation from the stem. When fruit begins to fall freely it should be gathered. When harvested, the pears should be placed in a dark, moderately cool, dry apartment, to be preserved a long time.

DRIED.

Pears may be dried in the same manner as apples, either by solar heat or in a slow oven. For preserving in cans or in sirup, pears are one of our best and most manageable garden products. The large amount of sugar in its composition renders its drying or preservation very certain. Perhaps the best method for common use is to remove the rind, cut into thin slices, and dry in the sun in the same manner as apples.

PRESERVED.

Being pared and cut into pieces of moderate size, say quarters, they are boiled, with about half weight of sugar, fifteen minutes or so, not enough to reduce the pieces to pulp at all, but sufficiently to cook thoroughly and put into heated cans and sealed quickly, as previously mentioned. If to be kept as a preserve in sirup, a little more sugar may be required.

PEACHES.

The peach in its general qualities so nearly resembles the pear that the same methods of preservation answer for both. Slight allowance in the time of boiling may be made for the superior juiciness of the peach.

BRANDY PEACHES.

Remove the skins by pouring on boiling water. Make a sirup of half a pint of water and half a pound of sugar to one pound of peaches. When boiling put in the prepared peaches and boil till tender. Removing the peaches to cool, continue the boiling of the sirup until it becomes quite thick, and add an equal

amount of brandy. Having placed the cooled peaches in a jar, put in sufficient of the brandy sirup to completely cover the fruit. When cold secure the mouth of the jar as for jams.

PLUMS.

This fruit possesses the excellences of the two foregoing, and from its similarity in juiciness and saccharine matter preserves equally well in all the various modes by the same treatment.

QUINCES.

Though a hard, firm fruit, with a glazed and somewhat oily skin, the quince has but feeble powers of endurance. Kept dry and cool, it remains a few weeks or perhaps, under very favorable circumstances, months without decay. It dries well in the sun in the same manner as apples, but is most generally used when preserved with sugar as peaches and other fruit.

STRAWBERRIES.

The constantly increasing attention this superb berry is each year receiving from the American people would seem to indicate that the modes of preservation should be correspondingly enlarged and varied; but the simple fact that this fruit does not permit its peculiarly rich taste to be transmitted to the preserved berry by any means yet tried, satisfactorily explains why its preservation is so unfrequently attempted. For preserving in all the various modes, it may be treated in the same manner as cherries.

TOMATOS.

This extensively used and highly valuable fruit differs in its general composition, and consequently in its preservative qualities, from the most of our field and garden products. It has very little of either starch, sugar, or cellulose. Being protected only by a thin skin, and having for its largest element water, it is eminently one of the most perishable of vegetable products. The skin being dense and glazed, affords a good protection so long as it remains unbroken; but unfortunately it is frequently unable to resist the pressure of rapid growth, giving way and exposing the body of the fruit to the direct action of the air. Paradoxical as it may seem, the absence of sugar acts adversely towards both decay and preservation; that substance being wanting which, in its diluted state, is most ready of fermentation, and which, in its concentrated condition, is an important preservative. From their aqueous composition, moisture exercises no specially adverse influence, and hence they are best kept fresh upon ice or in a cool, damp room. Cold alone is their preservative. The absence of sugar renders much more boiling necessary, to prepare them for air-tight preservation, than is required in most fruits. The time taken will depend altogether upon the juiciness; three or four hours will probably be requisite to concentrate the juice sufficiently; add as much sugar as the taste requires a few minutes before the boiling ceases. Sealed tight they keep unchanged through the season. For preserving, prepare and treat the fruit precisely as brandy peaches, with the exception of using double the amount of sugar, and omitting the brandy and water. For catsup, to a gallon add four table spoonsful of salt and an equal amount of pepper in kernel, and also of mustard and a little allspice. Boil an hour or more, then strain through a sieve, and put in any ordinary bottle, corking tight. For pickling, green tomatos, they having a bitter, acrid taste, should be scalded in salt water, afterwards cut in two crosswise, washed in cold water, and allowed to drain well. They are then treated as any other material for pickling.

VINEGAR.

All reference to vinegar as a preservative must be understood as being made to a pure cider vinegar. Chemical vinegars, such as are most commonly found in market, having various chemical properties, may either entirely fail to effect a preservation, or wholly consume the substance. For a good vinegar, to three gallons of pure apple cider add one gallon of soft water well sweetened with molasses, and expose to the sun or warm air till the acetic fermentation is nearly complete, then remove to a cool dry apartment. The cask should always be left uncorked.

WINE.

It has been previously remarked that starch readily passes into the saccharine fermentation, and sugar into the vinous; thus wheat, corn, rye, barley, &c., put in warm water, a certain portion of the starch within is changed into sugar, and if the fermentation is permitted to proceed till it passes on into the vinous or alcoholic, the sugar is changed into alcohol. The fluid now contains a portion of alcohol which is removed by distillation. As alcohol boils at a much less temperature than water, if the mixed fluid be gradually heated up to the alcoholic boiling point, the alcohol, being converted into vapor, will pass over into the receptacle, while the water will remain unaffected. In ripe apples, peaches, currants, blackberries, grapes, and similar fruits, there is a small per cent. of sugar with little or no starch. The juice is, therefore, so to say, already past the saccharine fermentation, and ready for the vinous. Left to the action of the atmosphere, all these juices in a few days ferment, *i. e.*, change whatever sugar there may be into alcohol, the amount of which will depend entirely upon the amount of sugar before fermentation. Such a juice is, in general terms, a cider; if its percentage of alcohol is increased by adding sugar before the fermentation, it is a wine. The process of checking the fermentation is similar in both, only that in the case of wine great caution is to be exercised not to cork too soon, as the energy of the fermentation, being much greater than that of cider, the safety of the corking may be exposed by too early closing. Mashing the fruit, but not so as to bruise the seeds, the juice on being pressed out is mixed with an equal amount of water, and from two to five pounds of sugar to a gallon of the mixture. Grapes usually require about three and a quarter pounds; currants, four pounds; blackberry and raspberry, three and a half pounds; peach and cherry, the same as grape; orange wine, the juice of a dozen oranges and three pounds of sugar to a gallon of pure water; the sugar in all cases should be the best white, lump, or crystalized. After the fermentation has nearly ceased it must be stoutly corked, and four or five months later bottled tightly. Sealed well it keeps for years without change. From the invaluable medicinal qualities of grape, currant, and blackberry wines, the certainty of their purity, connected with the fact that nearly every wine of commerce is drugged and utterly unfit for the sick chamber, their manufacture for home use is daily becoming more extensive. No port, sherry, or madeira, as commonly found in our market, is at all comparable to these wines in medicinal excellence.

TIMBER ON THE PRAIRIES.

BY SAMUEL EDWARDS, LA MOILE, BUREAU COUNTY, ILLINOIS.

THIS is a question which has engaged much of the writer's attention for over twenty years. The want of timber is the great objection raised against our "goodly land" by nineteen-twentieths of the visitors to it from timbered parts of the country, and however much the old settlers here who have become accustomed to it may plead that the objection is more imaginary than real, it is truly quite an obstacle to meet in the settlement of our prairies, whilst the prices of farm produce remain as low as they have been for several years past. Hedges of Osage orange, white willow, and buckthorn, will, probably, at no distant day, constitute the principal part of our fences. Enough timber is now growing in most counties for immediate necessities to fence and furnish building material and fuel; but in very many sections of our country the complete settlement and occupation would soon exhaust the home supply, demanding for future use importation or immediate planting and culture. With casual observers from abroad a supply for the purposes above indicated are the great requisites of the prairie region; but to one who, for nearly a quarter of a century, has faced our winter winds, coming almost without let or hindrance over a frozen surface from the Rocky mountains, gaining new force as they progress, timber screens as shelter for our homes, stock-yards, orchards, gardens, and birds, are *the great necessity* for timber here.

The great damage sustained by orchards throughout the prairie regions of our country by the severe winters of 1855–'56 and 1856–'57 is now, by many pomologists, attributed largely to the violent and long-continued westerly winds whilst the atmosphere was at a low temperature. At several meetings of our State Horticultural Society a number of our old orchardists have informed us that without shelter pears proved a failure; but, after some fifteen years' experience with trees planted in sheltered locations, they are fully confident that with it, and under-draining, satisfactory results will be and have been obtained.

The amount of fuel used by a family living on the open prairie, and of food consumed by live stock in a similar locality, would be greatly lessened if protected by a good timber screen, and our climate as a whole be greatly ameliorated if the system of tree planting was generally adopted. Whilst we more readily admit the favorable change to be gained in our winters by a general adoption of the system herein proposed, it is questionable whether the benefit to be derived in more equable summers, escaping to a great degree the extremes of wet and drought, (may we not add part of our tornadoes from which we now suffer so much,) would not be the greater of the two.

Nearly all of the early settlers of the prairies came here from sections of the country where timber was abundant, and the great study in regard to it had been how the most cheaply to get rid of it. They were, therefore, as a general thing, tree destroyers, not culturists, and, as a natural consequence, plied vigorously their former vocation on our native groves. The first settlers made their homes near the groves and timber belts of our streams, entertaining the idea generally that the principal part of the prairies would never be settled, or at least would be left as range for cattle during the lives of many generations, and

that the timber in the country was amply sufficient for the accommodation of the farms which would be opened.

But few years were necessary to change the minds of our people. Here and there settlers commenced their farms a mile or two from timber. One of their first improvements made was the planting of a grove, generally of locust. These grew rapidly for a few years, but soon became checked. At twenty-five years from planting it is questionable whether any other variety of timber planted here has made less wood. Within a few years it has been so generally attacked by the borer, which is destroying it, that no more of it will be planted for the present. In a few instances groves of butternut and black walnut were planted, which are giving good satisfaction. For this purpose gather the nuts in the fall and mix them with moist earth in shallow beds, say six inches in depth; leave them exposed to the storm and frosts of winter, which cracks the shell. Plant in April, in freshly-ploughed land, in rows running north and south, five to six feet apart, two feet in the row. They should be well cultivated four or five years. Nearly all the work of cultivation can be done with horse and plough or cultivator. By planting close an upright habit of growth is induced, and, as the trees advance in height, the lower branches, being shaded, die and drop off, leaving a clean bole free from knots. As the trees attain size and height, seeming to require thinning out, a part may be cut down, but not until they will answer many useful purposes to the farmer.

Probably the butternut, black walnut, wild cherry, red elm, and arbor vitæ, (commonly called white cedar,) and the red cedar, will eventually constitute the principal part of the timber grown on the prairies for fence posts, railroad ties, and similar uses. The cottonwood and Lombardy poplar have been planted to a considerable extent, are rapid growers, in a short time answer well as a screen, but the few uses to which they can be profitably applied, compared with other varieties which thrive as well, will doubtless preclude their extensive culture. They are easily propagated from cuttings eight inches long, taken off before the sap starts in spring, planted in thoroughly pulverized soil leaving one bud above the surface. Care should be taken to press the dirt firmly about the lower end of the cuttings.

Lombardy poplars here, eighteen feet high, were grown from cuttings planted in the spring of 1860.

The silver maple has been very largely planted of late; is a rapid grower; the timber valuable for many purposes. It is sometimes injured by a borer It is readily propagated from seed which ripens in May, and should be immediately planted.

For the last year or two the attention of all prairiedom has been attracted to the European white willow. A cutting of it, planted here in 1845 on the bank of a sod fence, has received no cultivation. The measure of the trunk, eighteen inches from the ground above any swell of the roots, is now over nine feet in circumference. When grown alone it naturally assumes a low branching form, similar to the silver maple; but closely planted, it makes an upright, towering tree, attaining, as Meehan informs us, a height of seventy feet. The same author says in regard to the family of willows: "Though many of them thrive in moist places, it is not so in all the kinds. Some of them do well in the driest soils, and are adapted to ornament every situation. They are destined yet to receive considerable attention." His prediction, made ten years since, is being rapidly verified all over the western prairies. About the year 1847 it was introduced into Ogle and Lee counties, where it was set in hedge rows.

Farmers in the vicinity, on noticing its efficiency as a fence, have for several years been quietly extending its culture, until there are now within a few miles of the original hedge between one and two hundred miles planted for fence,

and many acres of it for timber. It is used as hedge for both shelter and fence. It should never be planted with the anticipation of satisfactory results, except in well-prepared or in moist soil, mulched heavily at time of planting. Six to eight inches apart is the distance at which the cuttings have generally been set for hedge, though twice that distance is preferred by some. With clean culture for four years the bodies of the trees make an impassable fence against cattle, affording at the same time excellent shelter to stock and growing crops.

An intelligent farmer of Macoupin county grew a plant in two years from the cutting eighteen feet high, and thirteen inches in circumference. If planted on the south side of cultivated fields, where shade would be injurious, the tops may be cut off for fuel once in two or three years. An intelligent German neighbor informs the writer that it is cultivated extensively in Germany for fuel, cutting off the tops at eight or ten feet in height once in three or four years. It rarely sprouts from the root; splits freely, having quite an advantage in this respect over the cottonwood, poplar, and many other soft-wooded trees. The timber is durable if kept off the ground.

Rails of willow have been in use thirty years. Dr. Stimson, of Woodford county, and others, state from observation that it is durable for posts. Whilst the small twigs are frequently broken by severe storms of sleet in winter, large limbs are seldom, if ever, broken or split down—a serious objection to the silver maple. There has as yet been found no tree which appears as promising for immediate and permanent utility as the white willow.

From the prairie farmer, owning his home, evergreens should receive attention. They are much more effectual as screens than deciduous trees, and are, in fact, when planted in triple rows, perfect protection against winds, besides adding greatly to the beauty of the landscape, especially in winter.

Obtained of small size from the forests of Michigan, or from nurserymen who make the propagation and culture of evergreens a leading branch of their business, their cost is so trifling as to place them within reach of all, for screens around buildings, stock-yards, and for ornamental purposes. Those from the nursery would be best, and for the inexperienced would prove cheapest in the end.

Raising evergreens from seed is a tedious operation; few but professional nurserymen either know how to do it successfully, or are willing to bestow the requisite amount of care and attention. The ground for seed-beds should be deeply pulverized, and three or four inches of the surface should be mostly composed of sand and wood soil, sand predominating. The small varieties of seeds should be barely covered; the largest ones never over half an inch. Beds four feet in width, running east and west, may be covered with strip lath, nailed one-third of an inch apart to cross pieces, placed a foot above the surface, to protect from direct rays of the sun.

Boards should be placed along the south side of the beds. A slight covering of moss over the beds to retain moisture is beneficial, but should be removed before the plants prick through it, as they are very tender and easily broken. Remove the covering at dusk each evening, give a slight sprinkling of water, and replace the covering before sunrise.

"Damping off" at the surface of the ground is the greatest difficulty to be encountered in raising evergreens from the seed. Whenever plants are found thus affected, give the beds a liberal sprinkling of dry sand, to be repeated if found necessary; this is an effectual remedy.

Robert Douglas, esq., of Waukegan, was, it is believed, the first western nurseryman to introduce this mode of culture.

The first winter leaves two inches in depth are laid among the plants for protection. On a small scale, they are readily grown in shallow beds, say six

inches deep, nearly filled with the sand and wood soil, placed on the north side of a hedge or other screen. At two years, or, if standing thinly in seed-beds, at three years, they should be transplanted to nursery rows running north and south, two and a half feet apart, eight inches in the row. If land is not underdrained, it should be ploughed in lands some thirty feet wide, with deep dead furrows between.

In two years alternate plants, and two years later alternate rows, should be removed. Until planted in their final location, evergreens should be root-pruned or transplanted once in two, or, at most, three years. This induces the putting forth of fibrous feeding roots near the body of the tree.

Great care should be taken in lifting the plants to preserve their roots entire. They should be carefully kept from drying whilst out of the ground, as their sap soon hardens, forming a coat of gum insoluble in water. The feeding spongioles lose beyond recovery their functions if dried.

It is advisable to grout the roots at once in a mortar made by stirring clay in water to a proper consistency.

In packing for shipment, care should be taken to keep the roots wet and tops dry, as, if moist, the leaves are liable to heat. Young plants, just imported, should be shaded from direct rays of the sun, and mulched, by putting chaff or short straw among the plants, as a preventive against drought. If the ground be dry at the time of planting, water them thoroughly then; mulching will obviate the necessity for its repetition. Should there be a long succession of dry weather, a slight sprinkling of the tops after sunset is recommended. This is deemed indispensable where growth has been made whilst packed, and the shade in such cases should be dense.

In many parts of our country one-half of the native woods are matured by resinous sap, the same as required by evergreens and larches, which are also very rapid growers, and the timber valuable. They should be planted largely, especially on any part of our prairies, except very dry knolls.

Pines of all hardy varieties, junipers, balsam fir, and Norway spruce, succeed well on dry soils; arbor vitæs, American and Norway spruce, pines, and balsam fir, thrive in moist localities. The white pine has made a growth of four feet in a season here.

The culture of evergreens should be shallow, but not near enough to disturb the roots. As a substitute for cultivation, mulching has been found to answer every purpose, and cannot be too highly commended.

Whilst the returns from a timber lot planted with white willow, poplars, silver maple, and cottonwood would be sooner realized than from evergreens, the writer is fully of the opinion that, for a term of thirty or more years, as good an investment would be made by planting white and Scotch pine, Norway spruce, red cedar, American arbor vitæ, and larches. Timber belts, several rods in width, should be planted the entire length along the west side of each farm, around orchards, stock-yards, and anywhere except on the southwest side of dwellings.

Occasionally persons are found setting a proper estimation on the importance of planting timber for shelter and other purposes, and showing forth "their faith by their works." The influence of their example is being felt, and it is hoped that the day is not far distant when all will be satisfied of our great need in this particular, and of the entire feasibility of the plan proposed for supplying it.

THE AGRICULTURE OF MOROCCO.

BY V. D. COLLINS.

Having visited Morocco during the last year, the writer submits the following sketch, chiefly agricultural, of that almost unknown land.

Morocco—in Arabic the "farthest west"—is a fragment of one of the great African monarchies formed by the Saracens when their power extended from the Pillars of Hercules to the Ganges of India. It still embraces an area and population (222,560 square miles and 8,000,000 inhabitants) equal to New England and the middle States combined. It is bounded on the north by the Atlantic, the straits of Gibraltar, and the Mediterranean; on the east by Algeria; on the south by the Sahara; and on the west by the Atlantic.

As early as 712 the Saracens, checked westward by the Atlantic, pushed their conquests to the north across the narrow straits of Gibraltar, and occupied the Spanish peninsula. While there consolidating their dynasty, they cultivated, in the highest style, science and polite learning at Cordova, and agriculture in the valleys of Andalusia and the Mediterranean. Climate and soil being favorable, the Moors in their agriculture introduced a vast system of irrigation, which, nobler than the art-remains of Alhambra and Alcazars, has been bequeathed, a splendid legacy, to Spain. The *vega* or watered plain of Granada and the *huerta* or garden valley of Valencia are irrigated by the very canals planned and constructed by the Moors. From these plains, which the Moors declared surpassed those of Bagdad and Damascus in fertility and equalled Paradise in beauty, have been gathered, for many ages, two and three crops yearly.

So much has the system of irrigation, brought from Arabia and introduced into Morocco and Spain by the conquerors, influenced Moorish and Spanish agriculture, that a few statements in respect to it seem proper. The whole water systems about Valencia in Spain and Fez in Morocco deserve the closest examination by engineers and agriculturists. The *huerta* of Valencia, for instance, is irrigated by the river Turia, and so completely is it drained that its natural bed at its mouth is almost dry. There are eight canals, of which the *Monocada* is the great artery, supplying, so to speak, all the smaller veins of the garden plain. The idea of this network of canals is simple enough, but the execution of it is a noble triumph of hydraulic science. In order that all the farmers of the plain may have water in their turn and as much as they wish, careful engineering skill and wise administration are required. The regulations for the proper distribution of water are excellent, but sometimes among the farmers disputes do arise. These are adjusted by a tribunal composed of seven judges chosen for life, a vacancy being filled by the others from among the yeomanry and irrigators of the plain. These judges hold a court at noon every Thursday in the open air, on benches at the gate of the old Gothic cathedral in Valencia, when all complaints are patiently heard and all difficulties respecting irrigation adjusted. In this high court of common sense—originating in the east, introduced by the Moors into the west, and continued until this day in Spain and Morocco—no pen, ink, paper, special pleadings or pettifogging lawyers are permitted. The plain farmer-judges understand the subject well, and from their decisions there is no appeal.

Although these courts are less common in Spain than in Morocco, where they form an important part of the judicial system of the country, yet I have attended those at Valencia more frequently, as the proceedings were more intelligible to me and the surroundings more replete with historic interest. In both countries have I been impressed by the quiet, quick, inexpensive, and satisfactory decisions, based upon the statements of the disputants themselves and upon the Moorish common law.

The above remarks apply, for the most part, to the water system around Tetuan and Fez, though it must be acknowledged that the works of their ancestors in Spain were more extensive and every way superior.

The Moors, after occupying Spain over seven hundred years, and making it during the middle ages the home of agriculture as well as the other arts and sciences, were expelled in 1492, the same year Columbus discovered the New World. Let us follow this remarkable people back to Morocco, and speak of their country as it appears to-day. It is needless to remark that the Moors have sadly degenerated, and that, as a thousand difficulties beset the traveller, the statistics and descriptions of agriculture must necessarily be imperfect.

As the steamer approached Tangier, I could hardly realize that the landscape of green, rounded mountains and quiet, fruitful valleys, dotted here and there with tents, camels, cattle, sheep, gardens, and patches of ripening grain, was the northern confine of dusky Africa, the land of prophecy and mystery. Instead of a desert country it was one of verdure and beauty, with valleys, hills, and low mountains near the sea; while far away, blue and mellow in the distance, with clear sloping outlines, stood the Lesser Atlas, in bold relief along the margin of the sky. So quiet and transparent was the atmosphere that the most remote objects were plainly seen, while the lowing of herds and the cries of the muleteer fell faintly on the ear.

Tangier is the principal seaport of northern Morocco. It is situated just outside and west of the straits of Gibraltar, and possesses a tolerable harbor, though no great trade. It is easy of access, as several lines of steamers touch there weekly from the adjacent ports of the Atlantic and Mediterranean. The town, resting on the hillside, with lower walls bathed by the sea, is purely Moorish in architecture; the gloom of its narrow, winding streets and prison-looking houses being relieved, however, by gardens, minarets, mosques, and the interior courts of dwellings, filled with plants, flowers, and fountains of limpid water.

Tangier requires, like most Mohammedan towns, distance to lend enchantment to the view, but nature is everywhere attractive. Her wealth of scenery, climate, and soil, and her freshness of verdure and purity of atmosphere, compare favorably with any land.

The sea-coast mountains of Morocco, being rounded and low, are covered, on their northern slopes especially, with verdure to their very tops. The real mountain range of the country, however, the Greater Atlas, starting at Cape Ghir, on the Atlantic, runs nearly east through the middle of Morocco into Algeria. The Lesser Atlas range branches off to the left of the main chain, in the very heart of the empire, and, running to the northeast, strikes the sea near Tangier, and forms a part of the mountains first described. At the point where the two lofty and snow-shining Atlas giants meet, the sun of Africa burns so warmly on their brows as to start the sources of the four great rivers of Morocco.

The country embracing the Lesser Atlas rises gradually towards the great water-shed dividing the fertile lands from the desert, and is finely diversified by hills, table-lands, and valleys, the latter being watered by numerous streams springing from the snowy bosoms of the mountains. It is thus, in this land of the sun, where, during the dry season, the soil would be otherwise parched and barren, that nature furnishes water, which, in the hands of Spaniard and

Moor, becomes a magic power, turning the soil into gold. The streams flowing southward are dry in summer, but those running north and westward—among them eight considerable rivers, though none really navigable—are perennial, and spread fertility and beauty to the sea.

There is a wet and dry season in Morocco—the former corresponding to our winter. The thermometer seldom rises above 90°, and rarely falls below 40°. This range of temperature is preserved by the summer sea-breezes of the Mediterranean and the Atlas barrier, which cuts off or moderates the hot winds of the desert. Some of the table-lands of the interior are rocky and comparatively barren, but even these abound with vast groves of the date-palm and with flocks of sheep and superior goats, yielding the finest fleeces and food. On many of the mountain slopes are extensive forests, abounding in cork, cedar, ilex, cambba, acacia, walnut, and various trees yielding precious gums

As in Spain, the olive is the most extensively planted tree, and forms not only a striking feature in the landscape, but one of the chief sources of subsistence to the people. So important is the yield of this time-honored tree as an article of food, of domestic economy, and the arts, that it demands a brief notice.

Olive trees, in Morocco, are usually set out in rows, the young plants being branches cut from the parent stock in the month of January. The end of the cutting is usually split into four prongs held apart by a small stone, and then planted, banked, manured, and watered for one or two years. As the young tree grows, its exuberance is pruned into a few upright promising branches. It begins to yield lucratively about the tenth season; but, like man, is not fully developed before the thirtieth year.

The tree is in flower during the months of June and July; but all of the above statements are modified by the variety, situation, and latitude of the olive. The full-grown tree yields from two to three bushels of berries. These are picked in autumn or early winter, when they are purple-colored and shining, and a right beautiful and merry sight is the harvest-home.

The trees are generally beaten, contrary to Columella's advice, by slender poles, to disengage the berries, which are gathered up by men, women, and children, and carried to the oil-mill in baskets on back of mule or donkey. The berries are seldom sorted, as they should be, but thrown, as they are gathered, on a circular hollowed stone, over which another is made to revolve by mule or other power. The crushed mass is then shovelled on to mats, and taken to a rude lever press, where the juice is expressed. The liquor, as it flows out, is caught into a reservoir below, partly filled with water, and the oil, as it rises to the surface, is skimmed off and poured into large earthen jars. The pulp of the berry is sometimes subjected to boiling water to further disengage the oil; but generally it is used for fuel and for fattening animals. The olive oil of Morocco is certainly not so pure as that of some other countries, but the taste, it seems to me, is not so insipid.

Olives for pickling are usually gathered before they are quite ripe and while the skin is yet green, though not always. The berries are repeatedly steeped in water with some alkali added to hasten the change in taste, for naturally they are bitter and nauseous, and when this is accomplished, they are put into brine of simply salt and water, or of one composed of salt, thyme, garlic, and bay-laurel. The most common olives, well pickled, constitute an important part of the food of the poor and of the army ration. Indeed, both the oil and the pickled olive berry are very nutritious. They form an essential portion of the people's food, and no one who has come to use and like them will willingly exchange either for their substitutes in other lands.

Olive oil is also used extensively in the arts and as a medicine. The Moors use the poorer oil for lamps and in the manufacture of ordinary soap; while from the better kind they make, like the French and Spanish, the finest castile.

In this connexion I should speak of the date-palm, the pomegranate, the fig,

and the almond trees of Morocco. The first is regarded by the Moors as the special gift of Providence to their table-lands, where vast groves welcome the traveler and caravan, affording food, fuel, and shelter to man and beast. The date-palm yields per year about one hundred pounds of dates. Camels are exceedingly fond of the refuse dates and the crushed date stones, while the leaves are used for many purposes, especially in making baskets, bags, ropes, &c.

The pomegranate tree yields a rare and excellent fruit, in shape and size somewhat like our quince. The farmers suspend the fruit by the stem from the ceilings of their houses, when the rind becomes hard and preserves for months the rich juices of the fruit. The Moors introduced the pomegranate into Spain, where it became the symbol, as it now is the memento, of their golden age in Granada. As I once stood upon the ruddy towers of the Alhambra and looked down on the lovely Vega, where the pomegranate was then in bloom, I could not help observing that this fruit flourishes, and probably will survive the last vestiges of the Moor in Spain.

From the fruit of the fig and the nut of the almond trees the Moors compound a food which is not only condensed in bulk, self-preservative, and wonderfully nutritious, but as simple and healthful as it is cheap and delicious.

Land in Morocco is not enclosed as with us, the boundaries being marked by the channels of irrigation, by planted trees, by water-sheds, and by stones set up. Fields of grain and other crops are guarded by those in charge from the encroachments of stray animals, while flocks and herds feeding in the open country are watched by their attendants.

The real tenure of the land I cannot state with precision. I have been told, however, that it is the same as in most Mohammedan countries—owned by the proprietor, though at the disposal, if demanded, of the Sultan or Emperor of Morocco. This much I do know, that real estate, goods, cattle, and other property, can be transferred by a simple deed of sale drawn up and attested by two notaries public.

The superintendent of the cultivated land and of stock receives one-fifth of the yield, while ordinary farm laborers are paid from fifteen to twenty cents per day each. The government levies two per cent. tax on the yield of all cultivated lands, and the amount is estimated and collected before the crops are harvested.

Most of the farm implements of Morocco are rude, and resemble those of Arabia. As a general thing, the soil is not really ploughed, but merely scratched by a wooden plough; though in the valleys, where exact culture is demanded, an instrument, half spade and half hoe, is much used. Cattle are yoked by the horns, and very much used in farming—donkeys, mules, and camels, being the usual beasts of burden.

The soil of Morocco, wherever cultivated, especially by irrigation and manures, is exceedingly fertile, the valleys and plains yielding rice, wheat, peas, beans, barley, maize, durra (a kind of millet, and the chief food of the poor,) vegetable oils, figs, oranges, lemons, limes, grapes, raisins, olives, pomegranates, dates, almonds, and various other nuts, cotton, tobacco, sugar-cane, indigo, sesamum, many precious gums, honey, wax, hemp, saffron, madder roots, many varieties of bird seed, marjoram, cumin seed, henna, fennel, linseed, &c.

As a general thing, bees are not raised, except around Tetuan and Fez, though large quantities of honey and wax are gathered from the forests.

Owing to the nomadic habits of some of the population and to the peculiar civilization of others, to the impossibility of irrigating the more elevated lands and to the wrong policy followed until lately, of non-exportation of products to Christian countries, large tracts of territory are uncultivated, or used as pasture lands.

For many years a great demand has existed for grain and beef, especially in Italy, France, and England, and for wool in the United States; but no special inducements are held out by the government to increase the surplus products of the soil, while the producers are too often at the mercy of government officials, as in Palestine, Egypt, and Turkey.

In 1857 the Sultan of Morocco abolished all monopolies or prohibition on agricultural produce, and, in fact, on all articles of export except leeches, cork bark, tobacco, and other herbs used for smoking in pipes; but so little does Christian commerce stimulate the Moor, that he prefers, for the most part, traffic with the south and east by the caravans of the desert, and a pastoral to an agricultural life. The old Moorish agricultural skill certainly remains, but the sparseness of population, the religious and nomadic habits of the people, the configuration of the country, and the abundance and cheapness of food, do not greatly call it into action. For the present population, Morocco is, doubtless, one of the best and cheapest supplied countries in the world, abounding in fish, flesh, fowl, vegetables, grain, and all the fruits of southern Europe, but little or nothing of its wealth is exported.

The same Moorish taste and skill, however, which beautified the valleys of Andalusia and made the Alhambra appear like a vision of the Arabian Nights, are seen to-day in the gardens near Tangier, Fez, and Tetuan. As one walks along avenues bordered by running streams, and beneath arbors festooned with jessamines and creeping vines, whose pendant flowers with orange blossoms perfume the air, and sees, hanging in all directions, in the midst of the richest foliage, the golden lemon and orange, the luscious fig and pomegranate, and hears around him the hum of the bees, the gentle murmur of falling waters, and the more distant melody of birds, the whole seems like the Arabian poet's dream. Morocco has many such spots of beauty, where the most exquisite taste is displayed in rural embellishment. It is only when one gets from the narrow, filthy streets of the town into the gardens, and *patios*, or courtyards of the haughty Moor, that he begins to appreciate how much he loves the beautiful in nature, as well as her pathless deserts, her table plains, and her mountain solitudes.

In speaking of agriculture, or rather the want of it, in Morocco, it is necessary to refer to the different races occupying the country, their location, habits, pursuits, and civilization. The Moors proper compose the principal inhabitants of the towns. They hold the offices of state, civil and military, and are mainly the descendants of the Spanish Moors, speaking the Arabic somewhat modified by the noble Castilian speech. Being the ruling class, and otherwise occupied, their old love of agriculture has much abated, greatly to the detriment of their character and country.

The more ancient population of Morocco is generally divided into two great classes—the Erufins, hunters and herdsmen, who dwell in the mountains of the north, and the Schelluhs, who dwell on the lower slopes of the mountains and in the valleys south of the capital, practicing a comparatively rude agriculture, but excelling as artisans. These two great classes are not strict Mohammedans, as they eat the flesh of the wild boar and drink wine of their own making.

The Erufins, while rearing cattle, sheep, and goats, hunt lions, tigers, panthers, and the other noble game of the Atlas, whose skins, tanned and prepared for the market, always command a good price. Among these people are seen goats which rival those of Thibet and Cashmere. In the light of facts, it is time that the prejudice against this animal, perhaps caused by the Scripture contrast, the sheep with the goat, was removed. In the unhealthy regions of Morocco, on the western coast, and for enfeebled constitutions especially, the milk of the goat is deemed far more healthy and nutritious than that of the cow. It is used very extensively in Morocco and at Gibraltar for domestic purposes and for making curd and cheese, as in most eastern hilly countries. The cost

of keeping a few goats is nothing as compared to that of keeping a cow, while each will yield a quart of milk per day throughout a large part of the year. While the flesh of the kid is excellent as food, its skin makes the finest morocco leather, gloves, and garments. From its fleeces are woven in Morocco, as in Thibet and Cashmere, the finest scarfs and shawls, while the hair of the full-grown goat (the fleece weighing from four to eight pounds) makes strong, handsome cloths, of a lustre superior to those from the wool of the sheep or alpaca, receiving and retaining, also, the most brilliant coloring. The demand at the present time for woollen fabrics of the finest texture should turn the attention of our farmers, especially in the hilly and mountainous portions of our country, to the rearing of fine breeds of goats, since some of the costliest fabrics of commerce, which are as lasting as they are beautiful, are woven from the hair of this animal.

The second class of ancient inhabitants excels in the useful arts. Though turning their attention considerably to agriculture, yet the greater portions are devoted to mechanical pursuits.

The manufactures of Morocco are chiefly native linens, coarse silks, morocco leather, barracans, slippers, shawls, scarfs, the caps of Fez, beautifully mounted long-barrelled guns, Turkey carpets, mats, hides, soaps, oils, flour, and the tanned fleeces of animals.

These people are especially skilled as tanners. They understand the art of dressing the skins of lions, tigers, gazelles, antelopes, and the kids of goats, (with or without the hair,) and of rendering them as white as snow and as soft as silk by means of barks and plants indigenous to the Atlas mountains. In the city of Morocco there is one tanning and leather-dyeing establishment employing over one thousand hands. What are the especial barks, dyes, &c., used, or what are the processes followed, I am unable to state, as I was not permitted to visit the tanneries, and had no other means of information. The leather of the capital is yellow, that of the Tafelet green, and of Fez red. Silks and embroidered goods are also manufactured in these cities, while the artisans of Fez are celebrated as goldsmiths and cutters of precious stones.

The Jews, who came as exiles from Spain, are the principal jewellers, traders, and bankers of Morocco. The limited commerce of the country with Christian nations is chiefly in their hands, so far as the fixed population is concerned, though English and French merchants command the market. The Jews dwell mostly at Tangier, Tetuan, and Fez; and while the females rival their sisters of the olden time in beauty, modesty, and grace, the men are considered by no means a useful or productive element of the population.

The negroes, like the Jews of the country, are exotics. They have generally been imported as slaves, but are kindly treated, and often obtain their liberty. They form an important part of the military force of the country, and have somewhat mixed or intermarried with the Moor. The negro is evidently a favorite, for he occupies many posts of honor in the harem and state; and last winter, when I was at Madrid, the Moorish ambassador was there ratifying a treaty between Spain and Morocco, and a large majority of his suite was composed of the sable sons of Central Africa.

The Arab element of the population, as in the east, is widely scattered over Morocco, and composes the greater portion of the rural population. They adhere for the most part to a wandering, pastoral life, which is fatal to exact agriculture. They are a hardy, shrewd, active people, comparatively ungoverned, being compelled by the authorities to pay but a small property tax, and to contribute rations to military forces passing by or encamping near them.

The homes of this pastoral people are their shining tents, and their possessions, their flocks and herds. From these they principally derive their food, raiment, and wealth. As in the time of the Patriarchs, and in Central Asia to-day, this portion of the inhabitants shifts its tents from time to time, in order

to give the land rest, to obtain fresh pasturage, and to enjoy fairer seasons and a better market. Their hospitality is simple and sincere; and their tent life, with tabernacle, mosque, their schools and Koran, their reverence for their elders and the dogmas of the Prophet, and their free life and society with nature and animals, all strike the house and town-bred Christian man as strange, patriarchal, and charming.

The general color of the inhabitants referred to, except, of course, the negro, is a light yellow, though long intercourse with the women of Soodan has introduced several darker shades. They dress for the most part in light woollen and cotton goods, with turban and flowing garments.

When our American cotton goods were first introduced into Morocco, there was a great demand for them among all classes as an article of clothing; but the English imitated them so well, at a lower price, that the real American cottons were driven from the market.

It is estimated that there are in Morocco, at the present time, 500,000 horses; 6,000,000 horned cattle; 45,000,000 sheep, besides a vast number of camels, mules, asses, and goats.

The horses of several breeds are small, but finely shaped and very fleet, many being of pure Arabian stock. The latter are characterized by a fine muscular development, with a lean, long head, a broad forehead, a prominent and brilliant eye, an open nostril, and a flowing mane and tail. The skin of the head is thin, through which may be distinctly traced the leading veins. The horse is not much used in Morocco as a beast of burden, for the Moor, like the Arab, makes him his companion, and the favorite thorough-bred animal is a picture of grace, power, and beauty.

Grapes and barley are his usual food; but on the southern side of the Greater Atlas, and in the desert march, as in Arabia, a little barley, a few dates, and a draught of camel's milk, constitute his daily food. Considerable care has been taken by the Moors to preserve their breeds of blooded horses, and the yearly caravans to Arabia greatly facilitate this. Until recently it was very difficult to export from Morocco the best breeds of horses, asses, or cattle; but at present it is not so, though there is a heavy export duty on each.

During the Moorish occupation of Spain the above-named animals were largely introduced into the Peninsula, and from Andalusia exported to the pampas of South America. On these vast plains of Buenos Ayres I have seen immense droves of horses and herds of cattle, (propagated from Moorish breeds,) and the animals in both hemispheres are much alike.

The cattle of Morocco, like the horses, are small; but they work well, and afford excellent beef, hides, and tallow. The Moors might make the raising of this stock very valuable, as all the yield of the animal is in great demand in Europe. The garrison at Gibraltar is supplied with beef from Morocco, while hides, tallow, hams, bones, &c., are important articles of exportation.

The sheep of Morocco are of several native varieties—some larger than any in the United States. The traveller sees almost everywhere that peculiar breed, imported by the Moors into Spain, which has the broad tail loaded with fat, and which often weighs, when the animal is in good condition, from thirty to fifty pounds. The wool is fine and generally very white, and of lengthy staple. It is true the Morocco wools imported into the United States are rather inferior. This is owing to the fact that the best wools are exported by caravans, or are consumed at home.

Of the other domestic animals, fowls, ducks, turkeys, and geese are most numerous; while pigeons, partridges, rabbits, deer, antelopes, wild boars, and indeed game of all kinds, are everywhere plentiful. Shepherd and other dogs are also common, as in most Mohammedan countries; but swine, except in the mountains, are seldom seen or used, owing to the religious scruples of the mass of the people.

Without dwelling further on these domestic animals, which, for the most part, are common to Morocco and the United States, I would remark that no one travelling in the land of the Moor can fail to be impressed with the value of three other animals, well known there, but, as yet, not justly appreciated here, to wit: the goat, the mule, and the camel. Of the first I have already spoken; let me briefly notice the other two.

It is well known to those who have studied the subject, that the finest breed of jacks comes from Morocco, and that the cross between them and the Moorish stock of horses produces a very superior mule. In Morocco the mule is one of the most common and useful animals used by man. There, as might be the case here, he is noted for the *economy* of his keep, his *docility* of temper, his *endurance and steadiness* to labor, his *exemption* from disease, and his remarkable *longevity;* while, from his lighter frame and more cautious movement, he is less subject to casualties than the horse. Prejudice, ignorance, bad breeding, and cruel usage, have prevented mules from becoming favorite animals in America. It is far different in other countries, especially in South America, in Spain, and Morocco. There they are used not only for the saddle and as beasts of burden in crossing mountain passes, but are harnessed to the diligence and to the carriage of fashion and of state. Many of them are most beautiful, docile animals, so different from the bad-blooded, much-abused, and neglected mule of our country. When Ferdinand and Isabella, of glorious and happy memory, conducted their campaigns against the Moor, and the Moor against the Spaniard, their transportation was effected by mules. It is a question worthy of serious consideration whether or not much of the transportation demanded in our present war might not be more economically and efficiently performed by pack-mules than by wagons. In mountainous regions, or where the roads are bad and forage scarce, there is no question about it. A pack-mule will easily carry 300 pounds, and *one* muleteer can oversee seventeen mules, giving 5,100 pounds transportation; whereas the same number of pounds will require certainly *three* wagons, *three* teamsters, and *eighteen* mules.

To the farmer, at any rate, there is no doubt as to the superiority of the mule to the horse. "*The mule farmer,*" says Skinner, "may calculate with tolerable certainty upon the continuation of his capital for at least *thirty years:* whereas the *horse* farmer, at the expiration of *ten* or *fifteen years,* must look to his *crops,* to his *acres,* or a bank, for the renewal of his."

The writer of this sketch has seen the camel in Siberia, Central Asia, India, Arabia, Turkey, and on the southern and eastern shores of the Mediterranean, and therefore can speak with some knowledge of this animal. It is a great mistake to suppose that the camel is fitted only for hot climates, though doubtless his true home is Central Asia. The camel is stronger and larger in southern Siberia and Tartary than in Morocco, but not so fleet an animal. The dromedary is considered but a cross between the northern and southern breeds.

Of all the brute creation the camel presents the greatest marks of design and of adaptation to certain regions of the globe, and to peculiar phases of civilization. Often while riding upon or, when tents were pitched, walking among these animals as they were gathering their evening meal, or resting beneath their burdens, have I observed their habits and points of attraction. Patient, submissive, and enduring, they lead lives of toil and privation, and awaken in thoughtful minds, by association, the incidents and history of ancient times.

There are seven natural callosities on the body of the camel, upon which it kneels, rises, or rests, inasmuch as the ordinary skin would crack and be bruised upon rough ground, rocks, or the hot sands of the desert. While its teeth are nipper-shaped, in order to grasp and cut the toughest grapes, plants, and shrubs, its stomach is so constructed that it can digest the coarsest vegetable tissues. Its spongy feet (silent as those of the cat) are suited alike to sand, rock, and uneven surfaces: its nostrils can be closed to the drifting sand

and simoon of the desert, while its false stomach and fat hump can carry an extra supply of water and self-sustaining nourishment, when sorely pressed with thirst and hunger. In proportion as the land is hedged, fenced, and guarded, and the spontaneous products of the soil are superseded by those of culture, the camel disappears. He seems to thrive most on the coarse herbage and shrubbery of the wilderness, and on all those plants which are flavored by saline, pungent, and aromatic juices. Indeed, in case of necessity, the camel will refuse scarcely any green thing. He will feed upon the leaves, twigs, and bark of deciduous trees, and the coarsest grapes, thistles, reeds, rushes, weeds, and straw. In short, he will flourish on a diet which no other domestic animal would begin to touch. Even on the longest journeys he is seldom, if ever, fed, but left to gather his meagre food while marching, or after the halt of the day.

The value of a good camel in Morocco is from thirty to sixty dollars. At the end of the third year he is in full strength, which continues unabated for at least twenty years. The milk of the female, like that of the goat, is very healthful and nutritious. The ordinary yield in the desert per day is about one quart per camel; but in parts of Morocco where a more succulent diet is found it is from two to three quarts. The fleeces of some breeds of camels, weighing ten pounds each, are extremely valuable, and from which are woven the finest fabrics. The camels of Morocco carry from four to six hundred pounds each, averaging thirty miles per day for weeks in succession, and cross without accident mountain passes and the paths of the desert. In the Crimea, where the camel is used as a draught animal, a pair will draw a load of four thousand pounds, on a fair road, sixty miles per day, without eating, drinking, or resting.

Vast caravans, chiefly of camels, start annually from Fez for Arabia, and twice a year for Central Africa, taking with them each trip, to the one or other country, wools, woollen goods, hides, skins, grain, wax, fine leather, ostrich feathers, indigo, cochineal, cattle, sheep, &c., to the value of two million dollars. Such are some of the qualities and services of these "ships of the desert," which, like those of the sea, silently bear eastward and westward the precious merchandise of the Orient.

A few years ago, as an experiment, our government introduced some seventy camels into our southwestern country, at the cost of about thirty thousand dollars. In Texas and on our American desert they have been subjected, during government surveys, to the severest tests, being heavily laden, making long marches, and depending on the scanty forage and water found by the way. The result, thus far, has been highly satisfactory, though the experiment has been too limited in the number and breeds of the animals and in the time necessary for testing the matter thoroughly. Those who are familiar with the physical conditions of our territory west of the Mississippi, and of the countries where the camel flourishes, are perfectly agreed as to the great prospective benefit to be conferred on our nation by introducing the animal on a large scale into America. The following are some of the arguments in favor of such an undertaking, by those best acquainted with the camel: the economy of his original cost as compared with the mule or horse, when once introduced and fairly domesticated, since it costs nothing to breed the animal, while the young requires but little care and training, and is serviceable in his third year; the simplicity and cheapness of his saddle and other gear; the exemption from the trouble and expense of providing for his sustenance, driving, sheltering, or shoeing him; his great docility; his general freedom from disease; his longevity; the magnitude of his burdens; the celerity of his movements; his extraordinary fearlessness; the care with which he carries his burden and rider; the economical value of his flesh, and the applicability to many military purposes of his hair and skin; his great powers of abstinence from both food and drink; and his freedom from stampedes and other nocturnal alarms and losses.

The intelligent reader will naturally conclude that Morocco, being such a highly favored country, and situated on the highway of commerce and so near the great markets of Europe, would share in the trade and prosperity of nations; but such is not the case. A few remarks on this topic will conclude my imperfect sketch of Morocco.

The principal ports of Morocco are Tangier, Mogadore, Laroche, and Tetuan, all except the latter being situated on the Atlantic. Nearly all the articles mentioned in this paper as cultivated and manufactured in Morocco are exported in French and English bottoms, the Moors themselves not engaging in commerce by sea. The trade with the United States is mostly indirect, *via* Marseilles and Gibraltar, though in 1857 the Sultan instituted a liberal tariff in favor of our country. For the monopoly of the trade in leeches and cork bark, however, he is still paid over one hundred thousand dollars per annum. On most other articles there are no very high export duties; but no effort is made to develop the resources of the country and meet the liberal demands of foreign merchants. During the last year about one thousand vessels, of all classes, entered the various ports of Morocco, but the exports and imports, respectively, did not exceed four million dollars.

REPORT OF THE CHEMIST OF THE DEPARTMENT OF AGRICULTURE.

WASHINGTON, D. C., *January* 1, 1863.

SIR: I have the honor to submit to you the following report of the operations of the chemical laboratory of the Department:

The operations have been confined to a period of two months; for although commissioned by you to undertake the duties of chemist to the department as early as August 21, 1862, I was, immediately upon my arrival in Washington, detailed by the President upon special service, and not remanded to your department until the close of October. The organization of the laboratory operated for a further delay.

Major Adlum, the introducer of the Catawba grape, who published, at Washington, in 1823, a treatise upon the cultivation of the vine in America, made the following remarks respecting the Catawba grape, in a letter to Nicholas Longworth: "In bringing this grape into public notice, I have rendered my country a greater service than I could have done had I paid off the national debt."

From small beginnings the culture of the wine grape has become a source of great national wealth, with abundant promise for the future. The census returns show the number of gallons of wine made in the United States to have been, in 1840, 124,734; in 1850, 221,249; and in 1860, 1,860,008.

Within the last two years the impetus to the wine manufacture has been such that persons familiar with the subject estimate the actual vintage of the past year at 5,000,000 gallons.

Forty years ago Major Adlum, in his preface to the above-mentioned work, calls attention to the grape and to wine-making as a "valuable but too much neglected branch of agriculture;" and, speaking of this neglect, continues: "It was to prevent this evil (as far as I could be instrumental in preventing it) that I wished to obtain of the President of the United States, a few years ago, a lease of a portion of the public ground of the city for the purpose of forming a vineyard and of cultivating an experimental farm. It was my

intention, had I been successful, to procure cuttings of the different species of the native vine to be found in the United States, to ascertain their growth, soil, and produce, and to exhibit to the nation a new source of wealth which had been too long neglected. My application was, however, rejected, and I have been obliged to prosecute the undertaking myself, without assistance and without patronage; and this I have done to the full extent of my limited means. A desire to be useful to my countrymen has animated all my efforts and given a stimulus to all my exertions." It is an appropriate tribute to the author of these patriotic sentiments that in Washington, where he labored, the work in the laboratory of the Department of Agriculture should have been inaugurated with a chemical examination of the native grapes of our country.

CHEMICAL ANALYSIS OF GRAPE JUICE.

The operations in the laboratory, as well with sorghum as with grape juice, can only be regarded as preliminary to a more extensive investigation of the subject in the next season. These operations were begun after the period of the harvest of the respective crops, and the time was too brief to procure desirable specimens. The correspondence and communications of the new department were in progress of formation, and much labor in various directions had to be performed. Hence, in respect to grapes, specimens of the most important actually grown for wine, such as the Catawba and Concord, were not accessible. Some of the specimens procured were in too small quantity for proper examination, and some were of varieties useless for wine, while all were in a condition rendering a very rapid analysis imperative. I adopted the plan, in the present investigation, of analyzing all of the specimens received; determining in each case the specific gravity of the filtered juice and its percentage of dry grape sugar. Where the quality of substance permitted, I obtained the approximate percentage of juice in the grape, the percentage of ash in the juice, and that of *acid*, estimated as all tartaric acid. The latter results were obtained by titling Otto's ammonia test solution for vinegar by means of dry tartaric acid, and using this test to determine the amount of acid above neutrality in the grape juice. I also determined the amount of extract left by evaporating the grape juice and drying it at 110° centrigrade, (a datum usually furnished in such analyses;) but I omit these results in the present report, as they are by necessity erroneous. Although pure dry grape sugar will bear the above temperature, it is different in grape juice. In every instance the sugar was strongly caramelized. When evaporated in vacuo, the juice has a pleasant and pure flavor of grapes; but the rapidity of the analysis prevented the adoption of this method.

The sugar was determined by Fehling's copper test solution, of which the title was obtained by several determinations of its copper. In nearly every case of the sugar determination in this report, at least two were made for each specimen under examination, and none but accordant results were accepted.

The experiments were all performed upon the juice filtered through paper, and in every instance so rapidly that fermentation had no opportunity to impair the accuracy of the results. The grapes examined were derived from four sources: first, from the gardens of the Department; secondly, from the September exhibition of the Fruit Growers' Society of Eastern Pennsylvania, held at Philadelphia, specimens having been collected by Mr. William Saunders, of the propagating garden of the Department; thirdly, two specimens from Downingtown, Pa., through Captain I. R. Diller, of Virden, Ill.; fourthly, one specimen (Cuepern, No. 9) from Mr. Charles J. Uhlmann, an experienced and scientific grape cultivator of Washington. This grape is interesting as a foreign specimen, having been imported by Mr. Uhlmann three years ago from Sans Souci, near Berlin.

The following table embodies the results of the analyses of twenty-four varieties of grapes:

Table of analysis of Grape Juice.

No.	Designation of the grapes.	Approximate percentage of juice in the grape.	Specific gravity of the juice.	Percentage of ash in the juice.	Percentage of dry grape sugar in the juice, by Fehling's test.	Percentage of acid above neutrality in the juice, calculated as dry tartaric acid.
1	Raabe ..... Philadelphia exhibition	79.70	1.079	0.34	15.87	0.926
2	Baldwin's Le Noir ..... Agricultural Department, Washington, D. C.	82.67	1.107	0.49	20.36	0.933
3	Rebecca ..... do ..... do ..... do	80.82	1.088	(*)	11.63	0.514
4	Devereaux ..... do ..... do ..... do	73.19	1.096	0.78	11.55	0.803
5	Canby's August ..... do ..... do ..... do	70.48	1.082	(*)	11.70	(*)
6	Black September ..... do ..... do ..... do	72.60	1.057	0.80	8.95	1.754
7	Clinton ..... do ..... do ..... do	76.08	1.096	0.61	17.07	1.022
8	To Kalon ..... do ..... do ..... do	79.62	1.077	(*)	12.63	0.817
9	Cuepern ..... Charles J. Uhlmann ..... do	85.83	1.079	(*)	14.12	(*)
10	Cape ..... Philadelphia exhibition	78.90	1.065	(*)	10.45	(*)
11	Norton's Virginia ..... Mrs. J. Hoopes, Westchester, Pa., Philadelphia exhibition	77.62	1.089	(*)	15.90	(*)
12	Diana ..... do ..... do ..... do ..... do	74.82	1.085	(*)	14.87	(*)
13	Union Village ..... Dr. J. K. Eshleman, Dowingtown, Philadelphia exhibition	86.26	1.043	(*)	7.73	(*)
14	Montgomery ..... Mr. McMinn, Williamsport, Pa., Philadelphia exhibition	88.06	1.047	(*)	8.40	(*)
15	Cassidy ..... Philadelphia exhibition	Too few grapes to determine.	1.087	(*)	15.41	(*)
16	Herbemont ..... Mr. Engle, Marietta, Pa., Philadelphia exhibition		1.080	(*)	16.73	(*)
17	Delaware ..... Philadelphia exhibition		1.077	(*)	13.41	(*)
18	Marion ..... Mrs. J. Hoopes, Philadelphia exhibition		1.071	(*)	13.25	(*)
19	Trimon ..... Philadelphia exhibition		1.055	(*)	9.57	(*)
20	Ontario ..... S. Miller, Lebanon, Pa., Philadelphia exhibition		1.043	(*)	8.35	(*)
21	Elsinburg ..... Mrs. J. Hoopes, Philadelphia exhibition		1.062	(*)	10.76	(*)
22	Anna ..... Dr. J. K. Eshleman, Lebanon, Pa., Philadelphia exhibition		1.073	(*)	11.98	(*)
23	Schuylkill ..... Mrs. Reese, Dowingtown, Pa., by Captain Diller	77.64	1.069	(*)	14.60	0.811
24	Bland ..... do ..... do ..... do	81.60	1.072	(*)	14.94	0.838

* Not determined.

An examination of the table will enable a comparison to be made of the different grapes, and by the aid of Mulder's work upon the chemistry of wine we may also institute a comparison of these with foreign grapes. Mulder's remarks relate to the highly cultivated wine grapes of Europe, of the great variety of which an estimate may be formed from his reminding us that Chaptal, when minister of the interior, caused 1,400 different species of vines to be transplanted out of France alone into the garden of the Luxembourg.

Regarding the percentage of juice in the grape, Berthier's analysis of Chasselas and Rineau, grown in the neighborhood of Paris, shows a percentage, respectively, of 73.81 and 72.43. Of the specific gravity of grape juice, Chaptal found, in that of the Cher and Loire, from 1.0627 to 1.0825, and Fontenelle, in 1822, from 1.029 to 1.1283. In the juice of the grapes of Stuttgard, 1.066 to 1.099; in that of Marbach, 1809, from 1.054 to 1.047; in 1811, from 1.084 to 1.074; in the Neckar district, 1.050 to 1.090, and near Heidelberg 1.039 to 1.091. Respecting the percentage of sugar, Mulder gives from 10 to 12 for the percentage of total *extract* of the juice of fine purple grapes of Holland dried at 110°, which, of course, is not all sugar. He estimates the sugar percentage of the wine grapes of Europe between 13 and 30, as follows, viz:

Estimate.

Analyst.	Locality.	Per cent. of sugar.
Chaptal	Banks of Cher and Loire	15 to 20
Fontenelle	South of France	18 to 30
Guenzler	Stuttgard	15 to 22
Ruess	....Do	13 to 25
Schnebler and Koehler	Neckar	14 to 24
Klubeck	Styria	17 to 26
Metzger	Heidelberg	14 to 22
Balling	Bohemia	14 to 23

It is more important, however, to institute a comparison of the results of the present investigation with those obtained by other chemists upon our native grapes, using the valuable reports contributed by Dr. C. T. Jackson and Dr. Antisell to the Agricultural Report of the Patent Office for the year 1859. Dr. Jackson analyzed thirty-eight specimens of native grapes collected principally by John F. Weber, who made a tour for that purpose, under the direction of the government, through several of the northern States. The same chemist also determined the amount of tartaric acid in pure native wine. Dr. Antisell examined the juice of the Catawba from the Ohio valley with special reference to the nature and amount of its acid. Dr. Antisell obtained by precipitation about one grain of bitartrate of potassa from each ounce of juice, and a percentage of 19.6 grape sugar. The grapes contained about 62½ per cent. of juice. Dr. Jackson found in the pure wine from 0.6 to 2 per cent. of tartaric acid, while my experiments performed on the juice before fermentation yielded from 0.817 to 1.754 per cent. of this acid. But one specimen of the grapes analyzed by me was of the same variety as those analyzed by the above-mentioned chemist, and the locality of my grapes was different, being of more southern latitude. It may, therefore, be of interest to compare the average percentage of sugar obtained by Dr. Jackson and myself. The average percentage of sugar in the grapes analyzed by Dr. Jackson is 11.16, and in those analyzed by myself 12.5. I have calculated the percentage of juice in the grapes from Dr. Jackson's report, and find the average to be 67.23, while in the grapes analyzed by me it is 79.11. Dr. Jackson measured the amount of

juice obtained by pressing a pound of grapes, while I pressed variable weights, and calculated the percentage of juice from the weight of the moist residue. The difference of method cannot account for a difference of 12 per cent. in the juice determination; consequently I infer that the grapes of the present report were richer in juice, which juice was richer in sugar than the grapes analyzed by Dr. Jackson. Whether this difference is due to a difference of climate, to a superiority of 1862 over 1859 as a grape year, or to such a difference in the grapes analyzed as could render a comparison by averages unfair, may be a matter for consideration.

In interpreting the results of such analyses, care should be taken to avoid drawing erroneous conclusions. One of the difficulties in analyses of this character is to obtain *average specimens.* If a cluster of grapes is dryer or riper, if it has had the advantage of position upon the vine, its analysis would yield a result which could not be applied to the rest of the grapes upon the vine, much less to those of other vines. If the chemist could analyze specimens of the large quantity of must as it is prepared in actual vintage, the results would be certain for the average percentage of sugar; but as this cannot be done, he must content himself by multiplying the analyses and averaging the results. Care, therefore, must be taken not to draw more than general conclusions from the table of analysis. The numbers are accurate for the specimens examined, since they result from two *accordant* analyses of each specimen.

Analysis No. 14 gives a percentage of sugar 8.40 for the Montgomery grape. The portion analyzed was the lower half of a fine large bunch in good condition. The upper half was analyzed by the method of fermentation, and the percentage of sugar inferred from the alcohol produced was 12.12—showing a larger amount of sugar in the upper than in the lower half of the bunch. While the aid to be derived from chemistry by the vine-dresser, striving to introduce the most desirable vine, is great, the labor of such chemical investigation is also extensive. There is so much to be ascertained with respect to the constituents of the juice, and the methods of analysis are so imperfect, even with regard to important constituents, that practical results can only be obtained by a systematic concert of action among chemists who shall confine themselves to the observation of certain points. What Mulder says respecting wine applies equally to the juice of the grape, viz: "A chemical monograph on wine is at present impossible; in any age a single life would be insufficient for such a work."

In continuing this subject next fall, I would suggest, first, that attention be confined at that time to the data of the table of analyses of grape juice in this report, with the exception, perhaps, of the percentage of ash in the juice, which involves delay in a long series of rapidly made analyses, and with the addition of such other examination as to ferment, nature of acids, &c., as time may permit after the establishment of the above-mentioned data; secondly, that attention be confined to the following grapes: Catawba, Norton's Virginia, Delaware, Concord, and Mottled, seeking to analyze as many specimens of each from as many different localities as possible, obtaining average specimens from different vine-dressers who may be willing to communicate to your department their experience as to the cultivation, soil, climate, &c., influencing the crop, and subsequently as to the wine manufactured from the grape, which may also then be examined chemically and compared with the original juice; thirdly, I would invite the co-operation of all chemists residing in or near the wine regions, and who feel sufficiently interested in the subject, to analyze the juice of the above-mentioned grapes as to the named data, and to communicate their results to your chemist either before or after publication by themselves, when they will receive due credit, in your chemist's report, for their scientific labors. And since the filtering of pure grape juice through paper is a very

tedious operation, impeding very much the rapidity desirable in a research where many specimens of grapes should be examined immediately on their reception, I would suggest that in the proposed examination the juice be *not* filtered but strained, and suffered to stand in large tubes for an hour or two until the gross matter in suspension shall have settled. The finer particles left in the liquid would probably affect the result less than the possible change by exposure to the air while filtering, and at the same time the liquid examined would more closely approach the character of the must actually fermented in practice.

The determination of sugar in grape juice affords, other things being equal, a criterion for the alcoholic strength of the resulting wine. As 180 parts of grape sugar are equivalent to 92 parts of alcohol, a larger percentage of alcohol in the wine than half the percentage of sugar in the juice is impossible, unless either sugar has been added or the must concentrated by evaporation. Wine must be not only sufficiently strong in alcohol to keep well, but of such a character, in respect to acid and aroma, as not to be unpalatable. It results from the analyses, given and quoted in this report, that *in general* the grapes examined have too little sugar and too much acid in the juice for a desirable wine. Though good wine is made in some sections of our country from the pure juice of the grape, in other localities the addition of sugar to the must is extensively practiced. Hence the problem which the American vine-dresser has to solve is, to produce a healthy vine which shall bear fruit improved in these particulars.

There is no doubt that we have the climate in our extensive country to produce any given class of wines, and the climate of any given locality will necessarily influence the nature of the wine which may be made profitably in that locality. It cannot be long before the classes of vines suitable to our different climates shall be established; consequently chemical investigations of the juice of the fruit of those promising most for wine purposes is at the present time of great importance.

While this investigation is in progress, Dr. Gall's method of improving wine possesses a peculiar interest. Many years ago Liebig was much blamed (as countenancing adulteration) for suggesting to a society of vintners in Germany the addition of grape sugar to their must of a year very unfavorable for wine. Even now Mulder places himself "unconditionally on the side of those who consider everything added to or taken from the fermented grape juice (even the clearing it with albumen or isinglass, or the addition of substances containing tannic acid, in order to supply a deficiency of that acid) as adulteration." This would seem to be a refinement of purity; for if the wine contains nothing deleterious, keeps sufficiently well, and is of satisfactory flavor, it would appear to be immaterial whether it received its original sugar by the hand of man directly, or by being placed by man (in the vine) in such a condition that it could secure its saccharine matter indirectly by aid of the sun. While vine-dressers are improving the grapes of our country, vintners may surely be urged to seek to improve the available wine by methods which promise as well as that of Dr. Gall. Since in many sections the custom is prevalent of adding sugar to the must, it would be better, in this addition, to employ a systematic plan of operations.

To employ this method of improving wines, it is necessary to learn the percentage of acid and sugar in the must, so as to bring it, by the addition of grape sugar and water, up to the constitution of a standard must, containing 0.65 per cent. of acid and from 26 to 28 per cent. of sugar. This involves an analysis *to be made by the wine-maker*. It is probable that the instruments for these operations may be so improved as to place the analysis within the ability of vintners, and this subject ought to receive attention. It would be much more difficult, perhaps, to bring such instruments into use; but this

difficulty might be obviated by the Department placing a certain number of such instruments in the hands of experienced vintners whose operations are extensive, upon the condition of employing them and furnishing to the Department the results of their operations, together with the wine, for analysis. By this means not only would reliable information be gained as to the practical working of Dr. Gall's method upon American musts, but the instruments themselves would be subjected to a test, in the hands of those who are to use them, which would show what was needed for their further improvement.

Finally, in employing Dr. Gall's method, pure grape sugar and not cane sugar should be used. There is no difficulty in manufacturing this article in our country, and it will be made if found useful for wine purposes. Until such manufacture shall be established, the article in question may be imported from Germany.

SORGHUM AND IMPHEE.

About twelve years ago Count de Montigny sent from China to the Geographical Society of Paris a collection of seeds, among which were those of the sorghum. Of these seeds a single one germinated; its product was distributed, and the next year a gardener who had received some of them sold his crop of eight hundred seeds to Vilmorin, Andrieux & Co., of Paris, for a *franc* apiece. Through care and attention the new plant rapidly acquired notoriety, and many experiments upon it were instituted in Europe, both by scientific and practical men.

In the United States Patent Office Agricultural Report for 1854, page 219, the new cane is introduced to our country in the following words:

"*Researches on the Sorgho Sucré.*—A new graminaceous plant, which seems to be destined to take an important position among our commercial products, was sent, some four years since, from the north of China by M. de Montigny to the Geographical Society of Paris. From the cursory examination of a small field of it, growing at Verrières, in France, in autumn last, I was led to infer that, from the peculiarity of the climate, and its resemblance in appearance and habit to Indian corn, it would flourish in any region where that plant would thrive. But how far it will subserve the purposes ascribed to it in France, should it even succeed in any part of the United States, can only be determined by extended experiments."

The writer of the above, Mr. Browne, brought with him to the United States some of the seed of Mr. Vilmorin, which was distributed by the Patent Office to numerous persons throughout the country. In 1850 Mr. Leonard Wray, a practical sugar-planter, visited Kaffir-land from the East Indies, and found the imphee, around the huts of the natives, cultivated for chewing. Having become satisfied that the plant was valuable from its saccharine properties, he returned to Europe and planted it in England, France, and Belgium. He memorialized the French minister of war upon the subject, and exhibited the plant and its sugar to Mr. Buchanan, then American minister in London. He subsequently cultivated the imphee in Turkey, Egypt, the West Indies, the Brazils, the Mauritius, Australia, and finally in this country. Instead of one variety, as we have, of the Chinese sugar-cane, he has discovered among the Kaffirs no less than sixteen distinct kinds of imphee, of various degrees of saccharine richness, and differing very widely in the time required for their maturity. In 1856 Mr. Wray obtained the silver medal of the Paris exhibition for his imphee sugar, alcohol, seeds, and plants, and the French government granted him twenty-five hundred acres of land in Algiers for the prosecution of his investigations in the cultivation of this plant. (Olcott, pp. 26, 27.)

At the Rockford (Illinois) sorgho convention it was resolved that, in the estimation of the convention, there are only three kinds of cane, viz: Chinese sugar-cane, having black seeds growing in prongs from two to seven inches

long; the second or tufted variety, to be known as African; and the third variety, lately introduced, known as the Otaheitan, having long heads from seven to twelve inches in length and from one to two in thickness.

Mr. M. Day, jr., has communicated to me the following account of the Otaheitan cane:

The seed was received from the Patent Office, in the year 1859, by P. Heaveland, of southern Illinois, and passed from him to R. Hooper, of Schuyler county, Illinois, who cultivated the plant, and distributed the seed principally in his neighborhood; but last year gave it a more extended circulation. In the hands of those boiling down the juice of this cane, the sugar crystallizes a few hours after the strike is made. Mr. Cory, of Lima, Indiana, has obtained ten gallons of sirup from 1,200 pounds of cane, and nine pounds of crude crystallized sugar from twelve pounds of sirup. The seed is rather flat than round, the husk or outside of the seed being of a very dark purple. The joints of the cane are closer than in sorghum, and the stalk is tall. The stalk does not tiller out, but each seed produces one stalk. The general impression is that this plant is of the variety of imphee called Oom-se-a-na, or a derivative of the same, as it differs somewhat in appearance from that cane. Others, acquainted practically with this cane, believe it to be not imphee, but a different cane derived from the island whose name it bears. No specimens of this cane have been received at the laboratory, although its sugar has been analyzed.

In the United States the question of the new sugar cane, before the rebellion, received considerable attention, both from the government and from private individuals. In the Patent Office agricultural reports from 1854 to 1861, and in the present report of the Department of Agriculture, there are several articles from scientific and practical men, by which the progress in our sorghum experience may be followed. Drs. Jackson, Hayes, and Lawrence Smith have there examined the subject chemically, while several farmers have recorded their valuable practical experience upon the culture of the canes and yield of sirup. Whoever may desire to possess the information upon this subject in a connected form, may do so by means of the excellent work upon sorgho and imphee, by Henry S. Olcott. The increase of prosperity and population due to a continued peace, together with the gradual relative decline of the beet sugar manufacture in France since the dynasty of Louis Philippe, with other causes, affected the relations of sugar supply and demand in such a manner as to concentrate much attention upon the new canes everywhere. Upon this came the rebellion to intensify, in the United States, this attention. Extensive areas in different sections of the northern States were planted, machinery was procured for crushing the cane and boiling down the juice; conventions of sorghum planters and sugar manufacturers were held, and newspapers, devoted to the specialty of the new canes, were established. In the west the interest taken in the sorghum question has been especially great. In this section of our country the demand for molasses has always been large, and the farmers, observing in the new cane a means of supplying this demand by their individual labor, did not hesitate to plant largely. Letters received by the department state that in the localities of the writers the wholesale grocers purchased no sugar-cane molasses last fall.

Under these circumstances an examination of the sorghum and imphee became a matter of paramount importance in the laboratory of the new department. The same causes which operated for delay in receiving specimens, and for a rapid analysis of the specimens when received, in the case of the grapes, obtained with the sorghum and imphee. I cannot regard the examination, of which this is a report, in any other light than a preliminary one to more extensive operations next fall, and I would suggest that the department take early measures for procuring proper specimens for examination. It

well then to determine the ash of the plant and the constituents of its juice—cane sugar, grape sugar, gum, &c. Some of the specimens received for the present investigation were packed without ventilation, and thereby were lost by fermentation. I have to regret the loss in this manner of a valuable box from Isaac A. Hedges. Two other boxes were unavailable from having had no labels upon them or upon the specimens, or any other means of identifying them. In preparing specimens of cane for the laboratory they should be cut off close to the ground, and topped so as to leave them one joint longer than is usual when they are to be pressed for sugar boiling. They should be distinctly labelled with the owner's name and residence, kind of soil upon which the crop grew, nature of the seed, and a statement as to the origin of the seed. With each different specimen of cane a specimen of the seed should be sent, securely tied to the specimen. Some of the specimens of cane received were cut into short pieces, in the ends of which fermentation had commenced, so that only the middle joint of each could be analyzed. Some of the specimens were completely valueless on this ground. Others had to be rejected from the broom corn deterioration as shown by their seed. The subjects of analysis in this report were the juice of the fresh sorghum and imphee, the manufactured sirup, and the manufactured sugar.

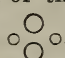
EXAMINATION OF THE JUICE OF THE CANE.

The lower portion of the cane was used for the extraction of the juice, which was obtained by a hydraulic press capable of effecting a pressure of 10 tons. The cane was cut into lengths of eight inches with a tobacconist's knife, and every piece was minutely inspected, so that none but unfermented cane should be employed. To the juice milk of lime was at once added, until a weak alkaline reaction was manifested; it was then raised to the boiling point, and at once filtered and cooled down to 20° centigrade, when the specific gravity was determined. One specific gravity bottleful was immediately operated upon for the determination of grape or uncrystallizable sugar by Fehling's copper test; while another bottleful was exposed to a temperature of 100° centigrade for two hours, with the addition of 9 drops of pure oil of vitriol, to convert the cane sugar to grape sugar. At the expiration of this time the acid was neutralized by carbonate of soda, and the grape or uncrystallizable sugar was again determined. From these data the percentage of the two sugars was obtained by calculation. The juice presented a similar appearance in the different canes. It was colored more or less of a yellowish green color, and had more or less of whitish sediment. This sediment, by the microscope under polarized light, showed small globules, which did not exhibit the black cross peculiar to starch. The sediment was, after boiling, rendered blue or light violet by tincture of iodine. In some cases the sediment did not react with iodine like starch. Lime, when boiled with the juice, separates a greenish feculent matter. The fresh juice of the cane, without addition of lime or heat, filtered through paper very slowly. It reduced the copper of Fehling's test when boiled with it. In these analyses the cane sugar percentage may be subject to a small reduction from matters in the defecated juice capable of being converted into grape or fruit sugar by sulphuric acid. The same result would obtain employing the optical analysis. On the other hand, this error would be diminished by the slowness with which the last portions of cane sugar are transformed by acid, (see Fehling's experiments,) so that a small part of the cane sugar escapes determination. Without taking into consideration this loss of cane sugar by incomplete action of the acid, I have estimated by the result of a particular experiment, (to be described in its proper place,) that the excess of cane sugar in my analysis is probably not more than one half per cent. In future experiments this point should receive attention, as it

is important, in the practical questions arising from the sugar manufacture, not only to know *exactly* how much cane sugar is really present, but what is the nature and amount of the gum-like bodies accompanying the sugar. I regret that circumstances made it impossible for me to bestow more attention than I have done upon this portion of the subject at the present time. The specimens of cane, sirup and sugar have been numbered in the order in which they have been received in the laboratory.

No. 1. Fresh sorghum cane, received October 20, 1862, from N. W. Hilbron, of Washington, D. C. Most of this cane bore the character of broom corn deterioration. The stalks which bore pure sorghum seeds were alone examined, but there was not enough juice for a quantitative determination of the sugar. Portions of the cane were dried with the following result:

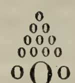
	Dried at 100°. c.	Dried in vacuo.
Water	65.52	67.74
Woody fibre, sugar, nitrogenized substances, starch, salts, &c.	34.48	32.26
	100.00	100.00

When pressed the cane emitted a whitish green, turbulent liquid of acid reaction to litmus, and which reduced Fehling's copper test solution when boiled with it. The juice appeared under the microscope as a transparent liquid with small, irregular, but roundish, cells floating in it, which cells did not exhibit the black cross of starch with polarized light. This juice could not be filtered readily as many of the cells passed through Swedish filtering paper. The juice was coagulated by heat, and the cells broken up, which permitted a slow filtration through paper of a loose texture. With tincture of iodine the following reactions were observed. The fresh unfiltered juice gave a blue color. The white sediment, boiled with tincture of iodine, gave also a blue color. The boiled filtered juice gave, with the same reagent, a violet color. When boiled, with the addition of milk of lime, the juice acquires a yellowish color, a green, slimy, feculent matter is separated, and the juice filters rapidly. The filtered liquid exhibits *no bluish color* with tincture of iodine; the greenish sediment on the filter becomes brown with that reagent. When thin horizontal sections of the fresh cane were observed by the microscope, numerous cells, filled with a transparent liquid, were observed. Scattered over the field were points which are sections of the long fibres which pass from joint to joint. Sections of the cane dried in vacuo exhibited the same appearance, the cells being shrivelled and empty, and the section of the *fibres* with yellowish matter encrusting them. No crystals were observed. When water was added to the specimen, the section of the long fibres presented the appearance of a section of four tubes, thus: . Sulphuric acid, added to the slice, gave a brown color, which was more intense around the fibres. Tincture of iodine gave a blue color intenser about the fibres. When a slice was boiled with Fehling's solution, it was colored red. When examined with the microscope, the color appeared yellowish, and was more concentrated around the tubular fibres. Pieces of the cane, boiled with Fehling's solution in a test tube, reduced the copper solution with a red deposition of suboxide of copper. As but few microscopic examinations of the cane were made, they may be all reported in connexion with analysis No. 1.

A specimen from analysis No. 13, which had been kept in a cool, damp room until fermentation had set in, gave the following results: It broke very readily at the joints; freed from bark it appeared somewhat translucent, like a frosted potato; the juice was very acid; a cross section, under the microscope,

presented the same appearance as specimen No. 1, except that the cells were filled with liquid; no starch reaction was afforded by the use of iodine. A slice boiled with Fehling's solution became red from reduction of copper, some of which was deposited on the watch-glass. This slice, examined under the microscope, showed an intense reddish yellow color about the longitudinal fibres which pass from joint to joint. The brown color given by sulphuric acid was also concentrated around these filaments.

A cane, from those used in analysis No. 5, was placed in a warm dry room; when examined, it was found to be perfectly dry in the extreme joints, and partially dry in the middle joints. The central joint had changed to a deep red color on the bark, which color had penetrated the pith of the cane, leaving a small portion along the axis white. The outer joints had almost the whole pith white. By the microscope, cross and vertical sections of an inner joint showed the color concentrated *along* and *in* the longitudinal fibres, which were of this appearance—



the color spreading from these to the neighboring cells. In the longitudinal section the tubular structure of the long fibres was very distinct. Sections of both the inner and outer joints of these specimens gave the same reactions observed by the microscope. Tincture of iodine deepened the yellowish color along the fibres with the suspicion of a blue color, although the question could not be decided. Boiled with Fehling's solution, a reddish yellow color, deeper in the neighborhood of the fibres, was manifested. Fragments of the white pith, boiled in a test tube with Fehling's solution, gave a dirty greenish deposit, from which a small quantity of the suboxide of copper settled and could be separated. When the red pith and red bark were treated in this manner, a very copious precipitate of this suboxide, having a pure red color, was deposited. In this specimen I examined the *cerosine* or wax-like matter coating the cane. On the bark, under the microscope, it appears a frosted white substance collected in small irregular masses. Scraped off, it is, by reflected light, a brilliant snow-white powder, not polarizing light, and composed of minute white curved filaments. No sign of crystallization could be detected. Cold ether appears to have a slight solvent action upon the cerosine; but the filaments do not disappear, and the evaporation of the ether leaves no crystals. When the glass slide is heated, the cerosine melts to globules, which cool to white semi-transparent masses. They now polarize light, the color changing, by rotating the analysing prism, from brownish to a blueish. Beautiful colors are developed by the selenite stage. Cold ether does not dissolve the melted cerosine, nor does cold oil of turpentine. Heated with the latter reagent, the masses disappear, and, on cooling, reappear like a sediment. It appears, from the microscopic examination, that the decomposition or alteration of the cane developes itself along the longitudinal fibres of the pith, and, from the ease with which the cane breaks at the joints, it is possible that some of these fibres, especially those which are near the bark, come to the surface of the cane at the joints. This would account for the deeper color on the exterior portions of the pith and on the bark, and also for the greater relative amount of grape sugar, apparently, in these portions. When the cane dries the solid matter appears to concentrate about these fibres, as if they determined the direction of the flow of the liquids in the cane during the evaporation of the water. It would be interesting to follow this question by the repeated analysis of the outer and inner portions of the pith, both when drying and while the decomposition or alteration of the juice by keeping is taking place.

Nos. 2, 3, and 4 were received October 22 from H. D. Emory, Dixon, Illinois, and analysed November 17 and 18.

No. 2, grown from pure black sorghum seed, at Jacksonville, Illinois, upon a sandy soil two feet deep, over blue clay. The expressed juice, treated with a few drops of milk of lime to a slight alkaline reaction, then boiled and filtered from the coagulum, yielded a clear, slightly brown liquid, appearing, by the addition of the tincture of iodine, of a deeper brown color. In almost all of these experiments two analyses were made of the defecated juice, and none but accordant results were accepted. This juice had a density of 1.068, and contained 8.02 per cent. of uncrystallizable, or grape, sugar, and 5.75 cane sugar.

Carbonic acid gas was passed through the juice remaining after the analysis; it was then filtered through bone black, and evaporated in vacuo; yielded a lemon-colored, sticky mass, which had a most agreeable flavor. This experiment was instituted for obtaining the taste of the sirup; and notwithstanding the degree to which the evaporation had been carried, on December 20 it had granulated in minute crystals, which, under the microscope (with a power of 500 diameters) exhibited clearly the form of cane sugar.

No. 3. Sorghum grown upon a sandy soil over shaly limestone. These canes yielded to pressure a reddish juice, in which, by the microscope, could be seen a few small cells floating. The addition of tincture of iodine gave no blue color when added to the juice.

Specific gravity	1.064
Uncrystallizable sugar	10.99
Cane sugar	3.26

An experiment upon this juice showed that the percentage of uncrystallizable sugar was not increased by keeping the expressed and limed juice twenty-four hours. Like all cane juice this had an acid reaction. The cane was very red on the outside.

No. 4. Red imphee, two or three weeks earlier than Nos. 2 and 3. This specimen was examined before 2 and 3, and before the arrival of my hydraulic press. The juice was obtained by wringing four stalks containing three joints each. It was a green turbulent liquid of slight acid reaction, giving a greenish brown precipitate with iodine; specific gravity, 1.062. By evaporating the juice at a temperature of 100° centigrade, 15.96 percentage of residue was left; but it was difficult to obtain a perfectly dry residue. The percentage of uncrystallizable sugar was 12.24 by Fehling's test. It contained *no cane sugar whatever.* Though sensible of no error, I repeated the analysis of this cane a few weeks later, when I obtained, as might be expected from evaporation having taken place, a juice richer in saccharine matter, but containing *no cane sugar.* The latter analysis gave: specific gravity, 1.072; uncrystallizable sugar, 15.71 per cent. I repeated this analysis a day later upon another portion of the same juice, and obtained the same percentage of uncrystallizable sugar. Sections of this cane were perfectly fresh-looking, and could not be distinguished in appearance from those sections of canes which were rich in cane sugar.

Nos. 5 and 6, from J. H. Smith, Quincy, Illinois; grown upon black prairie soil. (?) Mr. Smith states in a letter to the Department that he imported his seed from France last spring, and that he has been successful with the cultivation of the cane, especially with the Nee-az-a-na. I have received in the laboratory the following seeds from Mr. Smith:

Specimen No. 1, labelled Chinese cane seed.
Specimen No. 2, labelled Imphee Nee-az-a-na.
Specimen No. 3, labelled Boom-a-wa-na.
Specimen No. 4, labelled Oom-see-a-na.
Specimen No. 5, labelled E-éng-ha.
Specimen No. 6, labelled Boom-ee-a-na.
Specimen No. 7, labelled Koom-ba-na.
Specimen No. 8, labelled Zum-ba-ya-na.

Analysis No. 5. Chinese cane, juice greenish, slight sediment; examination with the microscope by polarized light elicited nothing.

Specific gravity	1.086
Percentage of uncrystallizable sugar	8.26
Percentage of cane sugar	7.20

No. 6. Imphee Nee-az-a-na. The cane was in fine condition. The juice was very clear when pressed, and more yellow than the specimens of sorghum hitherto analyzed. Polarized light with the microscope exhibited nothing peculiar. Flattened hexagonal cells, polarizing light, were observed floating in the liquid. A drop of juice evaporated upon a glass slide gave no crystals.

Specific gravity	1.074
Uncrystallizable sugar	4.77
Cane sugar	7.36

A portion of the juice, defecated by lime and filtered, was concentrated in vacuo. In nineteen days it had crystallized. By the microscope, the crystals were transparent and colorless, polarizing the light with beautiful colors (exhibiting the colored rings in some crystals) and distinctly of the form of cane sugar. It is important to note that the purified juice of this cane yielded a sirup of very pleasant flavor, so pronounced by many of the visitors to the laboratory.

Nos. 7, 8, and 9, were received from H. M. Carter, Lafayette, Tippecanoe county, Indiana. Another specimen, grown by Mr. Pfromer, was received in this lot, but it was spoiled, and had to be rejected.

No. 7, planted June 10, 1862, by Samuel Heffner, upon sandy prairie. When pressed, it gave a juice of reddish color, which was not very turbid.

The specific gravity was	1.044
Percentage of uncrystallizable sugar	6.31
Percentage of cane sugar	1.73

No. 8, planted by Henry Lehman, June 10, 1862, upon clay soil, yielded a smaller quantity of juice to the cane than No. 7, and contained a larger proportion of sediment.

Specific gravity	1.056
Percentage of uncrystallizable sugar	1.76
Percentage of cane sugar	8.26

No. 9, planted at the above date by Jonathan Baugh, upon black prairie soil. The general condition of this specimen was bad. I obtained juice from apparently unspoiled canes. The juice was reddish and rather clear.

Specific gravity	1.040
Uncrystallized sugar	4.92
Cane sugar	2.77

The two following specimens were received from W. W. Corbett, editor of the Prairie Farmer, Chicago, Illinois.

No. 10, of the variety known as White Imphee, was grown by Knox Taylor, of McLean county, Illinois, upon common high prairie soil. It was planted in hills, and cultivated like corn. It yielded a rather clear juice of a lemon color, which gave a very slight coagulum when defecated by lime. Tannic acid gave a slight precipitate with the defecated juice.

Specific gravity	1.037
Percentage of uncrystallized sugar	0.91
Percentage of cane sugar	5.06

I added to twenty-five cubic centimetres of the defecated juice an equal volume of ninety-four per cent. alcohol. No precipitate took place. On the addition of another equal volume of alcohol, a white precipitate fell, which, on being washed with a mixture of two volumes of alcohol of the above strength and one volume of distilled water, diminished to a slight residue. The residue blackened by heat and left an ash. Heated with sulphuric acid and subjected to Fehling's sugar test, it gave no precipitate of suboxide of copper. There was not enough juice at my disposal to pursue the subject any further.

No. 11, grown by K. H. Fell, upon similar soil with similar cultivation, and in the same county as in the case of No. 10. Neither of these specimens presented a good appearance externally, but the inner joints appeared perfectly sound. Notwithstanding their appearance, it will be seen that their relative proportion of cane sugar is large.

The juice of both specimens was very sweet to the taste. The juice of No. 11 was of lemon color, apparently pure and fresh, and with more white sediment in it than in No. 10.

Specific gravity	1.059
Percentage of uncrystallizable sugar	1.74
Percentage of cane sugar	9.43

Alcohol and tannic acid gave a small quantity of a white precipitate, not further examined.

Nos. 12 and 13 were received December 3, 1862, from Alexander Muzzy, Chicago, Illinois. No. 12 is sorghum, grown by William Moore, of Oregon, Ogle county, Illinois, upon alluvial bottom land. The juice was of a clear yellow.

Specific gravity	1.050
Percentage of uncrystallizable sugar	7.19
Percentage of cane sugar	2.21

No. 13, imphee, grown by the same, upon the same kind of land. The juice was of faded yellow color.

Specific gravity	1.053
Percentage of uncrystallizable sugar	7.17
Percentage of cane sugar	2.92

Nos. 14 and 15 (sorghum?) were received December 3, 1862, from A. S. Dimick, of Dixon, Illinois. No. 14 was grown by E. S. Colwell, of Amboy, Lee county, Illinois, upon clay soil. This juice had a light green color and was very sweet.

Specific gravity	1.054
Percentage of uncrystallizable sugar	3.02
Percentage of cane sugar	7.33

By a second experiment, in which the juice of a large quantity of cane was pressed for the purpose of fermenting, the following results were obtained.

Percentage of juice pressed from the cane	21.39
Specific gravity	1.058
Percentage of uncrystallizable sugar	3.67
Percentage of cane sugar	6.60

A particular experiment was performed upon the juice of this cane, to ascertain what effect the gum in it would have upon the accuracy of the determination of the cane sugar. Five times as much of the juice (purified by lime) as was employed for analysis was precipitated by two volumes of 94 per cent. alcohol and washed with undiluted 94 per cent. alcohol. The precipitate was mostly soluble in warm water, and a portion, burned to ash, left much lime. One-fifth of it was dissolved in water and treated with sulphuric acid at the temperature of boiling water, being subjected to the same operations as the sorghum juice when tested for cane sugar. The precipitate by the boiling Fehling's solution, though red, had not the distinct character of suboxide of copper, being flocculent. I therefore determined the amount of suboxide present in the precipitate by analysis, and obtained a result showing that 0.08 per cent. must be deducted from the percentage of cane sugar as found by ordinary process. 6.678 was found, which was corrected above to 6.60.

No. 15, sorghum (?) grown upon sandy soil, by David Pettinger, Amboy, Lee county, Illinois. The juice was of a faded color and of stronger acid reaction to litmus paper, when compared with Nos. 12, 13, and 14.

Specific gravity	1.056
Percentage of uncrystallized sugar	5.75
Percentage of cane sugar	5.17

By a second experiment upon a large quantity of juice pressed for fermentation, I obtained—

Percentage of juice extracted by pressure	19.61
Specific gravity	1.073
Percentage of uncrystallizable sugar	7.03
Percentage of cane sugar	6.98

The juices of Nos. 14 and 15 were fermented for the production of alcohol. The juices of the two varieties of cane were mixed and contained about 12 per cent. of uncrystallizable and cane sugar together. Five pints were fermented with brewer's yeast. The fermentation proceeded regularly and speedily to the end, when the wash was distilled and rectified, yielding nine and three-fourths fluid ounces of 60 per cent. alcohol and seven and one-fifth fluid ounces of 5 per cent. alcohol. The alcohol had a very pleasant flavor and aroma, and has met with the warm approval of judges of the article.

In this connexion the alcohol of Rev. A. Myers, of Springfield, Ohio, may be noted. The specimen was received December 30, 1862—was colorless and of good flavor, with the exception of being somewhat still-burned. It contained 50 per cent. of alcohol by volume.

The following table assembles in a connected form the results of the analyses of cane juice:

Table of analyses of Sorghum and Imphee Canes.

No. of analysis.	Planters or contributors and locality.	Kind of soil.	Kind of cane.	Specific gravity.	Percentage of uncrystallizable sugar.	Percentage of cane sugar.	Sum of the two sugars.
1	N. W. Hilbron .... Washington, D. C.	....	Sorghum	Undetermined	Undetermined	Undetermined	....
2	H. D. Emory .... Dixon, Illinois	Sandy soil on blue clay	....do	1. 068	8. 02	5. 75	13. 77
3	Do .... do	Sandy soil over shelly limestone	....do	1. 064	10. 99	3. 26	14. 25
4	Do .... do	Not stated	Red imphee	1. 062	12. 24	None.	12. 24
4 *bis*	Do .... do	.....do	....do	1. 072	15. 71	None.	15. 71
5	J. H. Smith .... Quincy, Illinois	Black prairie	Sorghum	1. 086	8. 26	7. 30	15. 46
6	Do .... do	.....do	Nee-az-a-na	1. 074	4. 77	7. 36	12. 13
7	Samuel Heffner ...... Tippecanoe county, Indiana	Sandy prairie	Sorghum (?)	1. 044	6. 31	1. 73	8. 04
8	Henry Lehman .... do .... do	Clay soil	....do	1. 056	1. 76	8. 26	10. 02
9	Jonathan Baugh .... do .... do	Black prairie	....do	1. 040	4. 92	2. 77	7. 69
10	Knox Taylor .... McLean county, Illinois	High prairie	White imphee	1. 037	0. 91	5. 06	5. 97
11	K. H. Fell .... do .... do	.....do	....do (?)	1. 059	1. 74	9. 43	11. 17
12	William Moore .... Oregon, Ogle county, Illinois	Alluvial bottom	Sorghum	1. 050	7. 19	2. 21	9. 40
13	Do .... do .... do	.....do	Imphee	1. 053	7. 17	2. 92	10. 09
14	E. S. Colwell .... Amboy, Lee county, Illinois	Clay soil	Sorghum (?)	1. 054	3. 02	7. 33	10. 35
14 *bis*	Do .... do .... do	.....do	....do	1. 058	3. 67	6. 60	10. 27
15	David Pettinger .... do .... do	Sandy soil	....do	1. 056	5. 75	5. 17	10. 92
15 *bis*	Do .... do .... do	.....do	....do	1. 073	7. 03	6. 98	14. 01

EXAMINATION OF SORGHUM AND IMPHEE SIRUP.

Some of the specimens of sirup sent to the department were lost for analysis from having no labels upon them by which they could be identified. In almost all of the specimens received there was a deposition of cane sugar in the vessels. Since I could not tell from any information at hand whether the sirup was placed in the vessels in an uncrystallized condition, I did not endeavor to estimate the proportion of crystals to sirup; but was contented with an examination of the crystals by the microscope, and, with an analysis of the clear sirup, to determine the amount of uncrystallizable sugar and cane sugar in solution. The analysis was performed as upon the cane juice.

Nine specimens of sirup were received from L. Bollman, of Bloomington, Indiana. The cane was grown in Munroe county of that State, upon soil bearing the general character of a clay loam, with more or less sand in it, and resting upon a limestone formation. On page 140 of this Agricultural Report will be found Mr. Bollman's article, to which reference may be made for a more particular description of the specimens of sirup analyzed.

Numbers 1 *and* 2.—Sirup by L. Bollman from two separate crops of mixed sorghum and imphee cane, cut towards the end of October, the sugar having been made in the beginning of November. The sugar sediment occupied one-third the length of the bottle. Mr. Bollman states that granulation commenced in four days. All of the sirups sent by Mr. Bollman were manufactured upon Cook's evaporators, except No. 3, in which a common sheet-iron pan was employed. The crystallized cane sugar sediment was examined by the microscope, to determine its form of crystallization. I expended several days upon this work of comparison, having prepared grape and fruit sugars from raisins, having selected fine specimens of crystals from rock candy, and having procured raw sugar of the Louisiana cane. By careful examination of the crystals under the microscope, causing them to rotate in different directions by moving the glass cover of the microscope slide, and by comparing the results with the forms exhibited by known crystals of grape and cane sugar, and with those delineated by Rammelsberg in his crystallographic chemistry, I became satisfied as to the nature of the sugar.

Cane sugar and grape sugar crystallize in different forms, the former plainly in an oblique prism, modified in different ways according to the laws of crystallography; the latter crystallizes with difficulty in wart-like masses, which are composed of needles or laminæ. Wherever *crystallized* sugar is mentioned in this report as having been observed, whether the article was prepared by myself from the juice, or furnished to the Department as raw sugar or floating in sirup, I recognized the form of cane sugar. In nearly all of the sirups examined I detected crystals of cane sugar by the microscope. These crystals appear under the microscope colorless by white lights, and colored by polarized light, showing beautifully in many cases the colored rings belonging to cane sugar. In the following experiments on sirups the clear sirup was taken from the top of the bottle, and its freedom from crystals of cane sugar ascertained by the microscope. Where crystals were observed the sirup was filtered by the aid of atmospheric pressure, using the air-pump. The results, therefore, of percentage of sugar refer to sugar in a state of solution. I refer to the table on page 526 for the results of the analyses of the different sirups.

Number 3.—Mr. Craig's Chinese cane contained a flocculent sediment mixed with crystallized sugar, occupying one-half the length of the bottle. The seed was planted on the last day of April, on moderately good soil, with sand and gravel beneath. The cane was cut towards the end of October.

Number 4.—Sirup of Chinese cane, grown by Charles Wier, upon land of which the brush had been burned, yielding a soil abounding in potash. Planted on the 15th of May, and cut at the end of September. A few scattered crystals of cane sugar were found in the bottom of the bottle.

Number 5.—By Charles Swearingen. Chinese cane sirup with crystals of cane sugar scattered through it. The cane was planted 1st of May, and was cut a few days later than No. 4.

Number 6.—Sirup from white seed imphee cane, planted by A. Wier upon good soil which had produced only four crops. The seed was planted 1st of May, and harvested when the cane was red. *One-quarter* of the length of the bottle contained a sediment of crystallized cane sugar mingled with some vegetable tissue. This sirup did not exhibit any crystallization before leaving Mr Bollman's possession.

Number 7.—Same seed, by A. Wilson. This is a light sirup, and contains a sediment of light-colored crystals of cane sugar, extending half the length of the bottle.

Number 8.—By Mrs. Sharpe, same seed; crystals of cane sugar, occupying not quite one-third the length of the bottle. The sirup is of a fine color.

Number 9.—From Mrs. Sharpe. The bottle is labelled Chinese, and is the mixed product of several lots of canes. Crystals of cane sugar occupied one-third the length of the bottle.

Number 10.—Sorghum sirup, from S. O. Stephens, Oneida county, Illinois. This specimen exhibited, by the microscope, one or two crystals of cane sugar.

Number 11.—From J. H. Smith, Quincy, Illinois; sirup from imphee, (Nee-az-a-na.) A sediment of crystallized cane sugar occupied half the length of the bottle.

Number 12.—From the same. Sorghum sirup, containing a few crystals of sugar at the bottom of the bottle.

Number 13.—Sorghum sirup, from Mr. Reily Root, of Galesburg, Illinois, and grown upon clay soil. Defecated by the use of clay, and purified by charcoal. The sirup had a slight flocculent precipitate in it, was of clear amber color, and solidified to crystals of cane sugar when a drop was exposed to the air.

Number 14.—Sorghum sirup, from S. W. Arnold, Cortland, Illinois. A clear sirup of good color and flavor.

Numbers 15—18.—Four specimens from the Chicago Steam Sugar Refinery, comprising first and second qualities of Illinois raw sorghum sirup, and first and second qualities of the refined sirup. The improvement in color and flavor is very marked in the refined specimens.

Number 19.—New Orleans molasses, bought in Washington, and analyzed for the purpose of comparison.

The following table exhibits the results of the sirup analyses.

Table of Sirup analyses.

No.	Name and locality.	Uncrystallizable sugar.	Cane sugar.	Water and impurities.	Variety of cane.
1 & 2	L. Bollman, near Bloomington, Indiana	20.35	39.17	40.48	Mixed
3	Mr. Craig, by L. Bollman, Indiana	25.04	33.60	41.36	Sorghum.
4	Charles Wier, by L. Bollman, Indiana	19.08	40.22	40.75	....do....
5	Charles Swearingen, by L. Bollman, Indiana	15.95	44.03	40.02	....do....
6	A. Wier, by L. Bollman, Indiana	29.75	29.29	40.96	Imphee..
7	A. Wilson, by L. Bollman, Indiana	28.11	35.62	36.27	....do....
8	Mrs. Sharpe, by L. Bollman, Indiana	24.25	34.80	40.95	....
9	Do.........do.	26.73	36.62	36.65	Sorghum.
10	S. O. Stephens, Oneida county, Illinois	24.11	39.67	36.22	....do....
11	J. H. Smith, Quincy, Illinois	26.77	32.66	40.57	Imphee..
12	Do.......... do	38.78	26.08	35.14	Sorghum.
13	Reily Root, Galesburg, Illinois	17.49	41.88	40.63	....do....
14	S. W. Arnold, near Cortland, Illinois	35.90	26.49	37.61	....do....
15	Chicago steam sugar refinery, 1st quality refined	48.91	12.77	38.32	....do....
16	Do..........do..........2d quality refined	39.51	21.32	39.17	....do....
17	Chicago steam raw Illinois sirup, 1st quality	34.22	23.82	41.96	....do....
18	Do..........do..........2d quality	43.98	21.11	34.91	....do....
19	New Orleans molasses	25.41	40.06	34.53	....

EXAMINATION OF SUGARS.

The sugars from sorghum and imphee were analyzed by the same methods pursued with the juice of the cane and with the sirup. They all possessed most distinctly the crystal form of cane sugar.

No. 1.—Imphee sugar, extracted by myself from the sediment of bottle No. 7 of sirup, (see analysis of syrup.) This sugar was drained from the sirup, boiled once with 94 per cent. alcohol, drained, pressed, and dried.

No. 2.—Sorghum sugar, from John L. Gill and son, Columbus, Ohio. Of fine color, large grains, and appeared to have been washed.

No. 3.—Imphee sugar of dark color, made by J. H. Smith, Quincy, Illinois, in ten days from the strike. This sugar was the same as in the sediment of sirup No. 11, and was made from the juice of Nee-az-a-na, No. 6, of my analysis of sorghum cane.

No. 4.—This specimen was made by the same person from the same cane. It was of fair color. The specimen analyzed was furnished by the Illinois State Agricultural Society, No. 1 of their convention, as a sample of 100 pounds received by them from the maker. No chemicals were used in the manufacture.

No. 5.—Presented by James Whitehill, Zanesville, Ohio, sorghum sugar, well crystalized, and of a good color for raw sugar. When boiled with 94 per cent. alcohol, and submitted to the microscope, the grains were shown to be composed of smaller crystals of the form of cane sugar.

No. 6.—Sugar from the so-called Otaheitan cane, presented by Isaac A. Hedges, Chicago, Illinois. A very fine article of raw sugar, and well granulated, the crystals appearing as No. 5.

No. 7.—Sorghum sugar, made by Joseph H. Steed, and presented by Mr. Day, jr., of Mansfield, Ohio, as sugar No. 29 of the Ohio State Sorghum Convention. A dark sugar, but well crystallized, and not to be distinguished under the microscope from the New Orleans sugar, No. 9.

No. 8.—Presented by the above as No. 18 of the above convention, sorghum

sugar, made by C. Cory, Lima, Indiana. The specimen was of good color, and well crystallized.

No. 9.—New Orleans sugar, presented by M. Day, jr., of Mansfield, Ohio, and submitted to analysis for the purpose of comparison with the sorghum and imphee sugars. It was rather dark and sticky.

No. 10.—This sugar, together with Nos. 11, 12, and 13, was presented by the Illinois State Agricultural Society for examination as specimens of imphee sugar. No. 10 was made by David Brown, of Rushville, Illinois. A little soda had been added to the juice in boiling. The sample was part of a lot of seventy-five pounds of sugar. It was of very fair color.

No. 11.—A sample of twenty pounds of imphee sugar, which was manufactured by H. R. Smith, of Quincy, Illinois, without the use of any chemicals.

No. 12.—By C. D. Roberts, of Jacksonville, Illinois, made without the use of chemicals; of very fair color.

No. 13.—Was made by D. S. Pardee, of Rockford, Illinois. Rather dark sugar, but of good grain. Lime water was poured upon the sugar while dripping.

No. 14.—This specimen of sugar was interesting as a sample of that made by Mrs. Hooker, of Schuyler county, Illinois, from the Otaheitan cane. It was of excellent grain, color, and general appearance.

No. 15.—Another specimen of Otaheitan sugar, from the maker, C. Cory, of Lima, Indiana. This sugar was by far the finest in appearance of any received by the Department, and its analysis justified its fair appearance.

No. 16.—This was a specimen of the beet root sugar now being manufactured in the west. The name Marshall was written upon the bottle, and the sample was accompanied by a copy of the New York Times of January 23, giving an account of the operations of Mr. Belcher, of Chicago, and the Illinois Central Railroad Company in introducing the culture of the sugar beet along the line of the above mentioned railroad. It is supposed that No. 16 was a specimen of the sugar alluded to in the Times.

No. 17.—Sorghum sirup, made by Rev. A. Myers, of Springfield, Ohio. This specimen was one of the most remarkable I have examined, from the fact of its containing a large proportion of *crystallized grape sugar*. Mr. Myers states that no addition was made to the juice of the cane, but that it was defecated by long boiling and by careful skimming. The canes were select, perfectly ripe, and had been cut two weeks before pressing. They grew upon a rich, sandy, limestone soil. The sirup was of clear amber color, with six or eight crystals of cane sugar at the bottom of the bottle, very distinctly characterized by the microscope. After standing for several days a precipitate began to form at the top of the bottle, and gradually extended downwards until the whole mass of liquid was solid, and could be turned upside down without displacement. The microscope revealed the crystal form of grape sugar. A portion of it was spread upon a brick to dry, and this dried portion was analyzed, yielding 64.11 per cent. of grape sugar, thus confirming the microscopic results. This is the only specimen of crystallized grape sugar that I have found in the sirup from the new canes. It was readily detected by the microscope, and no doubt was derived from the cane and fruit sugar in the juice by the mode of manufacture.

A specimen of sorghum wine patented by Mr. Myers has been subjected to analysis, with the following results: Wine two years old, color and odor of Madeira, taste acid, with an unpleasant metallic after-taste, due to iron, doubtless, from the evaporating pan. The wine contains acetic, phosphoric, and possibly malic acids. No reactions for tartaric and citric acids were obtained; nor for fusel oil by the ether process. The following is the behavior towards reagents: a slight precipitate by chloride of barium; none with the perchloride of iron, but a brown coloration of the liquid. There was no pre-

cipitate by chlorine water; a goodly one by nitrate of silver and oxalate of ammonia. An iron reaction was manifested by the ferrocyanide of potassium; a heavy bluish white precipitate by the acetate of lead. These reactions point to soluble sulphates and chlorides, to lime, and to iron. Density of wine 1.043; absolute alcohol volume percentage 11½, determined by the evaporation process. The density of the boiled wine indicated 14 per cent. sugar by Balling's table; but the correct percentage, determined by Fehling's test, is 8.77. One hundred cubic centimetres of the wine, at 62° Fahrenheit, saturate 0.73 grammes of caustic soda, which result corresponds to that of a very acid wine.

No. 18.—This specimen was pure white refined cane sugar, purchased in Washington, and analyzed for the purpose of comparison. I found it almost perfectly pure; it left no ash whatever when burned, and contained no hygroscopic moisture. It yielded the small amount of 0.84 uncrystallizable sugar, from which may be inferred that its organic analysis would have given the percentages of carbon, hydrogen, and oxygen belonging to pure cane sugar.

The following table gives the analytical results of the different sugars quoted above:

Table of analyses of Sugars.

No. of analysis.	Kind of cane.	Description.	Uncrystallizable sugar.	Cane sugar.	Water and impurities.
1	Imphee....	From sirup, No. 7	9.67	85.32	5.01
2	Sorghum ..	From L. Gill & Son, Columbus, Ohio	5.66	93.15	1.19
3	Imphee....	J. H. Smith, Quincy, Illinois	7.43	87.59	4.98
4	....do......	J. H. Smith, sample of 100 pounds sent by Illinois State Agricultural Society	6.89	81.37	11.74
5	Sorghum ..	Presented by James Whitehill, Zanesville, Ohio	8.68	88.31	3.01
6	Otaheitan .	Presented by Isaac A. Hedges, Chicago, Illinois	8.49	88.06	3.45
7	Sorghum ..	Joseph H. Steed, Woodsfield, Ohio, from Ohio State Sorgho Convention, No. 29	9.88	77.52	12.60
8	....do......	C. Cory, Lima, Indiana, from Ohio State Sorgho Convention, No. 18	8.99	78.80	12.21
9	Sugar-cane	New Orleans sugar, presented by M. Day, jr., Mansfield, Ohio	5.86	90.25	3.89
10	Imphee....	David Brown, Rushville, Illinois, by Illinois State Agricultural Society	6.35	85.23	8.42
11	....do......	H. R. Smith, Quincy, Illinois, by Illinois State Agricultural Society	7.01	82.27	10.72
12	....do......	C. D. Roberts, Jacksonville, Illinois, by Illinois State Agricultural Society	8.20	80.38	11.42
13	....do......	D. S. Pardee, Rockford, Illinois, by Illinois State Agricultural Society	13.03	83.64	3.33
14	Otaheitan .	Mr. Hooker, Schuyler county, Illinois	7.15	81.68	11.17
15	....do......	C. Cory, Lima, Indiana	3.46	87.56	8.98
16	Beet root ..	By Mr. Marshall, (from Chicago, Illinois?)	5.86	90.30	3.84
17	Sorghum ..	Rev. A. Myers, Springfield, Ohio*	64.11	12.32	23.57
18	Sugar-cane	Pure white refined cane sugar bought in Washington	0.84	99.16	None.

* Chiefly crystallized grape sugar.

RESULTS OF THE ANALYSES OF SORGHUM AND IMPHEE.

Having given in the preceding pages the results obtained in the laboratory of the Department by an examination of the juice, sirup, and crystallized sugar of the new canes, let us now compare these results with those obtained by others, for the purpose of eliciting what practical information we may upon the subject of sorghum and imphee. If any such were needed, the experiments establish beyond a doubt the existence of crystallizable cane sugar in the

juices of sorghum and imphee; but I consider the question settled by the experiments of others before those of the Department were instituted, and allude to the subject only because it was seriously and strongly asserted, at the Ohio State Sorgho Convention, that the crystals obtained by treating these juices are those of grape and not cane sugar. It may be well, therefore, for the benefit of practical farmers to set forth, in as plain language as the subject permits, wherein *cane, grape,* and *fruit* sugars differ. Among the many sugars known to chemists, these three are by far the most employed in common life.

1. Cane sugar occurs in the ordinary sugar-cane, in the sap of the maple, and the juice of the beet, without the admixture of any other kind of sugar. It crystallizes readily from a pure solution, in large oblique prisms. It rotates the plane of polarization to the right. It does not precipitate suboxide of copper from an alkaline solution of that metal (*Fehling's test*) at the boiling temperature. By being heated with acids, or by being boiled for a long time with water, it is converted into a mixture of grape and fruit sugar.

2. Grape sugar, or *glucose*, constitutes the white powder seen upon the outside of old raisins; it also forms the sediment arising in old honey. It is found in connexion with cane and fruit sugars in many fruits, and may be made artificially by the action of acids upon cane sugar, starch, or wood. Made thus it is used in Europe for adding to wine musts which are weak in sugar. It crystallizes *with difficulty*, forming cauliflower-like masses which, under the microscope, appear like fine needles or blades, and in some conditions as *six-sided* tablets.—(Gmelin.) It also polarizes to the right, but to a less degree than cane sugar. It is less sweet than cane sugar, one pound of the latter producing the same degree of sensation of sweetness as from two to two and a half pounds of grape sugar. At the boiling temperature it precipitates the copper of Fehling's test. While cane sugar has to pass into grape and fruit sugars before fermentation takes place, grape sugar ferments without further change.

3. Fruit sugar occurs, as its name partly implies, in acidulous fruits with grape and cane sugars. It occurs also in molasses, as before stated. It is not capable of crystallization, but exists as a sirup, or, when dried, as a transparent candy. It is as sweet as cane sugar. It rotates the plane of polarization to the left. At the boiling temperature it removes the copper from Fehling's test solution, like grape sugar. It ferments without passing into any other kind of sugar. These are the most prominent differences between the three sugars.

As "polarization to the right or left" cannot be sufficiently explained without many words, the unscientific reader is requested to accept, in the above description, that "cane, grape, and fruit sugars behave differently towards polarized light."

A great want of clearness rests in the public mind as to grape and fruit sugars, arising from the carelessness with which scientific men use the terms, employing the words "grape sugar" or "uncrystallizable sugar" either to pure grape sugar, to pure fruit sugar, or to a mixture of the two. The mixture of grape and fruit sugars arising from the action of acids, ferment, or water upon cane sugar is called "*inverted*" sugar, "*grape*" sugar, and "*uncrystallizable*" sugar; being thus named differently by different persons. "Inverted sugar" is the proper name, which is derived from the change of action upon polarized light from right to left. I have called the grape or fruit sugar of the sorghum "*uncrystallizable* sugar" in this report, since, whether it be pure fruit sugar, or whether mixed with a little crystallizable grape sugar, it is uncrystallizable to all the practical purposes of the sugar-maker.

The practical results of our present chemical knowledge of the sugars may be briefly stated, as follows: Grape sugar is practically uncrystallizable in the manufacture of cane sugar, as it remains in the molasses; it is also much less

sweet than cane sugar. Fruit sugar is as sweet as cane sugar, but does not crystallize. Cane sugar may be transformed into inverted sugar (which is a mixture of grape and fruit sugars) by means of acids, long boiling with water, and fermentation, &c.; *but neither of these last sugars can be changed again into cane sugar* by any process known in chemistry. For practical purposes the difference of composition of the three sugars, as shown by their organic analyses, need not be discussed here; it is, however, important to note that they form compounds with salts, and that these combinations with the salts naturally in the vegetable juices associated with the sugars do not crystallize. In the compound of *cane* sugar with lime the cane sugar is not destroyed or "inverted" by boiling, but *grape* or *fruit* sugar in combination with lime are rapidly destroyed by boiling.—(Souleiran.)

Let us now proceed to an examination of the results of the chemical investigations upon sorghum and imphee, commencing with the sugars, and proceeding through the sirups to the juice of the cane.

THE SUGAR.

The sugars were analyzed without having been first dried. As will be seen by reference to the table on page 528, they contain a large percentage of cane sugar, some uncrystallizable sugar and water. They vary in color from dark to quite light, and do not contain, as far as my experiments go, any substances preventing a proper refining process to be effected upon them. The following table of the analyses of 50 (dry?) specimens of raw sugar by Pelouze and Fremy (Cours de Chémie Générale, vol. 3, page 359) may be interesting in this connexion.

No.	Locality.	Color.	Percentage of cane sugar.	No.	Locality.	Color.	Percentage of cane sugar.
1	Brazil	Dark brown	81	26	Bourbon	Light yellowish	91
2	Martinique	do	80	27	Martinique	do	89
3	Bourbon	Tell brown	81.5	28	Havana	do	90
4	Surinam	do	87	29	do	do	93
5	Brazil	do	84	30	do	do	91
6	Bourbon	Reddish	84	31	Guadaloupe	do	88.5
7	Java	do	88.5	32	Bourbon	do	93
8	Bourbon	Dark gray	84	33	Guadaloupe	do	85.5
9	Guadaloupe	do	83	34	do	do	92
10	Java	Light reddish	81	35	do	do	94
11	Bourbon	do	91.5	36	do	do	94.5
12	Egypt	do	86	37	do	do	95
13	Brazil	do	82	38	Bourbon	do	95
14	do	do	86	39	Havana	do	96.5
15	Surinam	Light brown	91	40	Bourbon	do	96
16	Guadaloupe	Yellow brown	87	41	Guadaloupe	do	94
17	Surinam	do	91.5	42	do	do	95
18	Bourbon	Yellow gray	90.5	43		do	95
19	Martinique	do	86	44	Guadaloupe	do	95
20	do	do	89	45	do	Very light gray	96
21	do	do	89.5	46	do	do	96.5
22	do	Yellowish	90.5	47	do	do	97
23	Brazil	do	92	48	Bourbon	Almost white	96.5
24	Guadaloupe	do	83	49	Guadaloupe	do	99
25	do	Reddish yellow	90	50	New Orleans	White	100

Professor R. S. McCulloch, in his research upon molasses by optical analyses (see public documents No. 165, Senate, 2d session twenty-eighth Congress,) gives the following as the result of the general practice of sugar refining in the United States. Thirty per cent. of white sugar and seventy per cent. of brown yield—

By the vacuum process.		By the old process.	
Refined	55.4	Loaf	40.0
Bastard	22.9	Lump	13.6
Molasses	17.4	Bastard	19.6
Dirt and waste	4.3	Molasses	24.5
	100.00	Dirt and waste	2.3
			100.00

By comparing the table of my analyses of sugars (page 528) with the results obtained by Pelouze and Fremy (page 530) it will be seen how well the analyses of sorghum and imphee sugars agree with those performed upon the raw sugars of the sugar-cane. In Pelouze and Fremy's analyses, white New Orleans sugar was taken as the standard, and placed at 100 per cent. In my analyses white refined sugar was made the standard of comparison. In the table on page 528 the first column of percentages indicates the "uncrystallizable sugar" obtained by means of Fehling's copper test solution. I have labored under the difficulty of not being able to obtain pure grape sugar for determining the strength of the test solution. The sulphate of copper employed in making the solution was twice crystallized, and then analyzed to determine its purity, by taking two specimens from different parts of the bottle. These analyses gave *exactly* the same results, and a difference of only 0.09 per cent. oxide of copper when compared with the theoretical percentage. This would involve an error of only 0.001 per cent. of sugar, by operating with ten grammes of saccharine substances and ten cubic centimetres of the Fehling solution.

THE SIRUP.

It will be seen, by the table upon page 526, that the specimens of sirup generally contain a larger proportion of cane sugar than uncrystallizable sugar. This cane sugar is held in solution by combination with the salts natural to the juices of the cane, by the viscous character of the molasses, (which in all molasses impedes a free motion of the molecules of cane sugar seeking crystallization,) and by the presence of gums and other impurities. Doubtless a portion of this cane sugar could be extracted from the molasses. Professor McCulloch obtained, in the research before cited, the following results of the optical analyses of the molasses of the sugar-cane:

	Uncrystallized sugar.	Water.	Cane sugar.
Porto Rico	57.86	20.10	22.04
New Orleans	66.64	8.46	24.90
Porto Rico	62.55	6.95	30.50
Do	57.88	21.42	21.70

Other observers have obtained the following results: Biot and Soulerain found 40 per cent. of cane sugar in molasses from the sugar-cane, Ventzke, (Knapp's Technology, III, 310)—

Green bastard sirup.

Cane sugar	47.9
Sugar sirup	30.9
Water	21.3
	100.01

My analysis (No. 19) of New Orleans molasses yields 25.41 per cent. of uncrystallizable sugar, 40.06 of cane sugar, and 34.53 of water, which agrees with the analysis by others. The sirup from sorghum and imphee bears, as may be seen from the analyses, a very strong resemblance to that from the sugar-cane. The peculiar taste or flavor of the sirup called "sorghum taste" is due to imperfect methods of purification during the manufacture, and may be chiefly obviated by proper management.

A comparison by taste of the specimens of the raw and refined sirups of the Chicago steam refinery affords a good illustration of this fact. The sirup No. 13 contains, by analysis, a larger amount of cane sugar than uncrystallizable sugar. This specimen is yet perfectly fluid, and contains a slight flocculent sediment. A few drops of the sirup which had been weighed for analysis was left exposed to the air in a capsule for ten days, and became, at the expiration of that time, converted into a solid mass of crystals of cane sugar. The relative value of the sirup in saccharine richness may be readily seen by a comparison of the numbers in the table of 526 page.

THE CANE AND JUICE.

By reference to the table on page 528 the varied results of the relative proportion of cane sugar to uncrystallizable sugar is very striking. The analyses are not numerous enough to institute more than a general comparison between sorghum and imphee. The following is an average of the results of my analyses:

Table of mean composition of the Juice.

	Of sorghum.	Of imphee.	
		1st mean.	*2d mean.*
Percentage of cane sugar	4.29	4.13	6.19
Percentage of uncrystallizable sugar	6.08	7.00	3.65
Total	10.37	11.13	9.84

By the sorghum *mean* we do not get much more than ten per cent. of sugar in the juice, of which the cane sugar is to the uncrystallizable sugar as 2 to 3. The first mean of the imphee analysis shows about the same actual percentage of cane sugar, but proportionally more. I do not think this mean gives as fair a representation of imphee juice as the second mean, in calculating which analyses Nos. 4 and 4 bis have been omitted. These analyses, showing a large percentage of uncrystallizable sugar and no cane sugar whatever, have a marked influence upon the mean. In the second mean there is about ten per cent. of total sugar, of which the cane sugar is to the uncrystallizable sugar in the proportion of 2 to 1, (more correctly 2 to 1.17.)

Before proceeding to a comparison of these results with those obtained by other chemists, a word should be said with respect to the condition of my specimens. It may be supposed that in some instances fermentation had proceeded to such a degree as to convert some of the cane sugar partially or totally into uncrystallizable sugar. As, for example, in analyses Nos. 4 and 4

bis, I am not aware of any such change, as far as careful examination of the cut cane, with and without the microscope, might show. Such a change might have taken place, notwithstanding the fresh appearance of the cut surface; but it is remarkable that analyses Nos. 10 and 11, the canes of which appeared spoiled at the ends, and of which the leaves were much moulded, give a comparatively small proportion of uncrystallizable sugar. In analyses 12 and 13, containing a large proportion of uncrystallizable sugar, the juice, as well as the cane, were of perfectly fresh appearance. The juice of analysis No. 3 was of reddish color, and may have experienced a change of cane to inverted sugar. During the progress of the experiments, I observed that many of the specimens of the juice had a tendency to the mucilaginous fermentation. The very interesting and late experiments of Berthelot and Buignet, (Liebig's Jahresbericht for 1860, page 539,) upon the relations of the sugar during the ripening of oranges, show that this fruit contains both cane and fruit sugar in variable proportions, having in the acid unripe fruit sugar in excess. When the fruit is ripe the absolute amount of fruit sugar has not experienced any change, but the percentage of cane sugar has materially increased. In these experiments the fruit was plucked in the green state; some of it was at once analyzed, and some was laid aside to ripen, after which it was also analyzed. In this example, notwithstanding the presence of an acid, not only was there no change of cane to fruit sugar, but there was an increased formation of cane sugar. There are differences of opinion among scientific men as to the formation of cane sugar; but it seems to appear in the sorghum and imphee that starch first changes to fruit or grape sugar, which then becomes cane sugar. When decomposition of the cane sets in, the cane sugar is first changed to uncrystallizable sugar, after which it ferments. The saccharine richness of the cane has been found in practice to increase, if the canes are kept for a certain length of time after having been harvested. The following table gives the average results of experiments performed upon the new canes:

AUTHORITY.	LOCALITY.	CANE.	PERCENTAGE OF—			
			Cane sugar.	Uncrystallized sugar.	Total sugar.	Juice pressed from the cane.
Vilmorin	France	Sorghum	11¾	4¼	10.16	50.60
Avequin	Louisiana	....do			10.15	42
L. Wray	Georgia	Imphee			16	70
Col. Peters	....do	....do				52
Madinier	France	Sorghum	10⅛	5⅞	16	
C. T. Jackson	United States	Imphee	9	6	15	
Do	....do	Sorghum			10.15	
Rewul	France	....do				50.55
Duret	....do	....do				50
Turrel	....do	....do			10.20	50.60
Hardy	....do	....do			13	50.67
Lawrence Smith	United States	....do	10	2	12	
Lovering, Sept. 28	Pennsylvania	....do	5.57			69.70
Do..Oct. 23	....do	....do	7.23			
Do	....do	....do	5.58	7.14	12.72	
Wetherill	Indiana and Illinois	....do	4.29	6.08	10.37	
Do	....do	Imphee	6.19	3.65	9.84	
Gössman	Germany	Sorghum	6.7			70.75

It follows, from the experiments thus quoted and reported, that the largest proportion of *cane sugar* to *uncrystallizable sugar* is afforded by the juice analyzed by Lawrence Smith, to wit, as 10 to 2. My *average* results fall far below this; yet if the analyses of my best canes are taken, their juice will compare favorably with that of the analysis of Smith. For example, by the analyses numbered 8, 10, 11, for every 10 parts of *cane* sugar found, we have respectively 2.1, 1.8, and 1.8 per cents. of uncrystallizable sugar. It is remarkable that in analyses 10 and 11, the juices differing so much in actual saccharine richness should contain the same *relative proportion* of cane sugar to uncrystallizable sugar. When my mean results are compared with the results afforded by the practical experiment of Mr. Lovering, who grew the sorghum, analyzed its juice, and converted the same into cane sugar and molasses, it appears that my mean of sorghum analyses gives very nearly the same proportion of cane sugar to uncrystallizable sugar, and that my imphee mean gives a *larger* proportion of cane sugar. I think that my analyses and their means will give a moderately accurate reflection of the present state of the sorghum and imphee culture in our country.

There are, doubtless, finer canes grown than I have examined, and richer, both in sirup-making quality and in the proportion of cane sugar present; but the analyses probably represent the present condition of the cane as planted.

The country suffers from the deterioration of the seed by hybridization, in the first place. Secondly, we have to learn by practical experiments of planting, *(interpreted by chemical analyses,)* the best plant to adopt from the sorghum and the fifteen different varieties of the imphee. Lastly, having the plant, we must learn the best soil and mode of cultivation to produce the purest juice and the richest in cane sugar. From present knowledge no certain information can be given as to the relative merits of sorghum and imphee, or as to the soil best calculated for the plant. Among the many practical men who have visited the Department while these experiments were in progress, there is much difference of opinion upon both of these points. It appears to be the fact, however, from the analyses, that the imphee contains the largest proportion of cane or crystallizable sugar. The analyses of the ash of the plant shows that a light sandy calcareous soil is best adapted to the plant, which is confirmed by the experience of most farmers.

In all sugar-making plants, the heat and light of the sun play a very important part in the formation of the sugar. The beneficial influence of a favorable soil might therefore be overcome by unfavorable conditions as regards the sun, as the presence of certain salts interferes very much with the crystallization of sugar. Any soil or culture increasing the proportion of such salts in the juice is prejudicial. Avequin asserts for the ordinary sugar-cane, that the larger the percentage of sugar in the juice the smaller is found to be the percentage of the above-mentioned salts.

THE USES OF THE NEW SUGAR-CANES.

Time and space in the report are insufficient for more than a mere enumeration of those uses of the sorghum and imphee which are established upon a sound scientific basis. With regard to the value of these plants as forage crops, the reader may be referred to the practical results already given in the Agricultural Reports of the government. It appears that the seed of the plant as an article of food is coming into more general favor than hitherto. W. F. Breck, of Grove City, Franklin county, Ohio, furnished to the State Sorgho Convention of January 6th, flour, bread, rusk, doughnuts, and cake. The latter were sweetened with the sorgho sirup, and are said to have been very palatable. The flour was of a purplish color, from imperfect hulling of the seed. The alcoholization of the sorghum is a fact well established, and from this the vine-

gar making quality of the material follows as a natural consequence. Both alcohol and vinegar of a good quality have been made in the laboratory.

A specimen of sorghum wine, made by a process patented by the Rev. Mr. A. Myers, has been presented for analysis. This wine has the aroma of sherry, and is of acidulous taste. Several methods are given in Olcott's work on the sorghum and imphee for the manufacture of a wine from this plant. The fibres of the plant would, doubtless, make an article of paper when treated according to the method of Welsbach.

The plant is also susceptible of affording a red dye, which may, by the usual tin mordants, be applied to fabrics of silk and wool. The following is the method of preparing it given by A. Winters—(Liebig's Jahresbericht, 1859, page 754.) The pressed canes are left to ferment in heaps until the color changes to a red or reddish brown. They are then cut up, dried, and washed. The color is extracted by a weak lye of caustic potash. By neutralizing the alkaline solution by a weak solution of oil of vitriol, the color falls in the form of red flakes, which are easily soluble in alcohol, alkalies, and diluted acids.

ON THE MANUFACTURE OF SORGHUM AND IMPHEE SIRUP AND SUGAR.

The following table gives the average composition of certain sugar-bearing plants, as generally accepted by chemists:

	Sorghum.	Sugar-cane.	Beet-root.	Maple sugar.	Maize.
Water	75.6	72.1	83.5	....	....
Sugar	12.0	18.0	10.5	5.0	10.0
Wood fibre	12.4	9.9	6.0	....	....
	100.0	100.0	100.0	100.0	100.0

In the juices of the above plants the sugar is all in the state of "*cane*" sugar, except in the sorghum and maize. In these two plants it is a mixture of cane sugar and uncrystallizable sugar. The sap of the maple, though dilute, is very free from substances which impede the manufacture of crystallized sugar. The manufacture of sugar from maize has never been carried on to a great extent. The experiments upon the manufacture, which have been made upon a larger or smaller scale in different localities, in France, and in this country, have never enabled it to compete in the market with other sugar. Sugar was extracted from Indian corn by the ancient Mexicans before the Spanish invasion. Probably a portion of the attention bestowed upon sorghum sugar will be now devoted to that of maize, since the difficulties of manufacture must be similar in the two plants. The problem offered to the consideration of the sugar-maker consists in obtaining the largest possible quantity of *good* raw sugar (or of the best refined sugar) from the juice. It is easy to make a small quantity of a crude article with a moderate outlay of knowledge and capital; but the manufacture, to become available, in a commercial point of view, must be carried on as an art; that is, involving knowledge, skill and money. That this is true is abundantly proved by the actual results of the manufacture of sugar from cane and beet-root. The sugar-cane contains from eighteen to twenty per cent. of pure cane sugar, of which the planters obtain (where the improved machinery is not in use) from six to eight per cent. of raw sugar, and from two to three per cent. of molasses. Two experiments by Duprey, performed upon 63,000 and 17,750 killogrammes of cane, showed whence this loss of sugar proceeded, as follows: In 100 parts of cane, containing eighteen per cent. of cane sugar, there were, (Knapp, page 309,)—

Obtained	as raw sugar	7.3 to 7.9	per cent.
	as molasses	1.8 to 2.0	per cent.
Lost	in the bagasse	2.8 to 3.3	per cent.
	in the process of manufacture	6.1 to 4.8	per cent.
Total		18.0 18.0	per cent.

Johnston (Chemistry of Common Life, page 209) gives the following schedule of the loss of sugar in the practice of the West India islands, compiled from the results of several observers.

Of the whole sugar of the ripe cane—

One-third is left in the bagasse	6 per cent.
One-third of the remainder in the skimming	2½ per cent.
One-third to one-half the second remainder in the molasses	3 per cent.
In the muscovado sent to market there are	6½ per cent.
Total	18 per cent.

The improvements in the machinery and chemical process of sugar have enabled the attainment of more favorable results than the above, both in the West India islands and in the United States. These improvements have been, for the most part, borrowed from the beet-sugar manufacture of Europe, which is a model of chemical and mechanical skill. In the earlier period of the beet-root sugar manufacture, from six to seven per cent. of raw sugar and from two to three per cent. of molasses were obtained from the 10–10½ per cent. of saccharine matter in the root. At the present time from seven to eight (and even more) per cent. of sugar are obtained, of which—

From three to five per cent. are best sugar.

From two to four per cent. are second quality.

From one to two per cent. are molasses.

In solving the sorghum problem we shall have to adopt, to a greater or less extent, the chemical and mechanical treatment of the sugar cane and beet-root for sugar. The general principles involved in the manufacture of sugar from these two plants are as follows:

1. Extraction of the juice.
2. Its defecation or clarification.
3. Filtration through animal charcoal.
4. The evaporation by boiling the filtered juice.
5. Second filtration through animal charcoal.
6. Boiling down the juice to the point of crystallization.

Before entering upon the explanation of the chemistry of the process, it will be necessary to inquire into the nature of the vegetable juices under treatment.

NATURE OF BEET-ROOT JUICE.

This juice contains, first, water; second, cane sugar; third, cellular matter from the vegetable cells; fourth, albuminous (nitrogenous) matter of several kinds, as follows: (*a*) pure vegetable albumen, coagulable by heat; (*b*) a matter becoming successively red, brown, and black by the oxidation of the air, (this substance is contained only in certain cells of the beet;) (*c*) another substance containing nitrogen and resembling gelatine, and which may be precipitated by lime; (*d*) several other nitrogenous bodies the nature of which is not yet well known: these nitrogenous substances decompose with the greatest ease, having a tendency to convert the cane sugar to grape sugar, and also to yield products of decomposition which hinder crystallization; fifth, pec-

tine, a substance not containing nitrogen, which, under certain circumstances, takes the form of jelly; sixth, gummy matter; seventh, fatty matter; eighth, coloring matters, odorous and aromatic; ninth, mineral salts; tenth, free acid. In beet-root that has sprouted, the acid reaction of the juice is stronger, and in such roots some of the cane sugar has been converted into grape sugar.

NATURE OF SUGAR-CANE JUICE.

. The sugar-cane contains from two to three times as much woody fibre as the beet; the juice is, however, very much purer, being generally a pure solution of cane sugar in water, with traces of mineral salts, albumen, and nitrogenous matter, coloring matters, &c. The nature of the ingredients is very similar to that described for the beet-root; small as the deleterious matters are in comparison with the juice of the beet, they are abundant enough in quantity to bring about all the injurious effects of fermentation, formation of grape sugar, &c., during the manufacture.

NATURE OF SORGHUM AND IMPHEE JUICE.

This juice being new, has been much less studied than that of the beet or cane, and now offers a rich field for investigation as to the proportion and nature of the albuminous and gummy matters contained therein. I have noted one experiment in the present investigation showing a very small amount of gum in the defecated juice of one specimen. The probability is that we shall find matters of the same nature as are found in the beet and cane juice, though varying in amount, (and even in certain instances in kind,) according to seed, soil, cultivation, and climate or season.

The success of the beet sugar turns upon the agricultural treatment of the vegetable. It is easier, by a proper course of agriculture, to keep substances injurious to the manufacture of crystallized sugar out of the juice, than when once present to take them out by the manufacture. In this case a loss of sugar is always involved. The sorghum and imphee juices are much purer for sugar manufacture than beet juice; their molasses is as valuable as sugar-cane molasses, (which is a subject of popular use in this country,) while the beet sugar molasses, on account of its bad taste, cannot be eaten, and is used only for the manufacture of alcohol.

The problem of sorghum sugar at this period presents more hope of solution than did that of beet sugar in the beginning of that industry; but for success, those working upon it must take account of the chemical nature of the juice. This juice differs from sugar-cane juice in the important particular that a portion of its sugar is in the condition of grape or fruit sugar. In estimating the value of such juice, we should be governed by the percentage of *cane* sugar in it; for not only can no crystals be obtained from the uncrystallizable sugar, but the products of decomposition of the fruit or grape sugar by lime, heat, or fermentation, afford obstacles to the formation of the crystals of cane sugar.

THE CHEMISTRY OF THE SUGAR MANUFACTURE IN GENERAL.

There are generally present in saccharine juices: water, cane sugar, mineral salts, gum, albuminous and other nitrogenized bodies, together with free acid, or acid salts. In sorghum and imphee juice there is, in addition to the above, fruit or grape sugar. The nitrogenized ingredients and acid of the cane, with the aid of the oxygen of the air, have a tendency to introduce fermentation, which converts cane sugar to uncrystallizable sugar, besides adding other substances inimical to crystallization.

1. In pressing the juice, therefore, methods must be adopted which perform the work *quickly*, and the juice should be immediately subjected to the next process, which is—

2. *Defecation or clarification.*—Several modes have been adopted or proposed

at different times for effecting defecation; that usually employed is lime. The temperature of the juice is raised, milk of lime (whitewash) is added until the reaction is faintly alkaline to litmus paper, and the juice is then boiled for a short time. The heat is then shut off, when clarification rapidly takes place A thick green scum rests on the top of the pan, while heavier matters sink to the bottom. This treatment separates all matters capable of precipitation by lime at the boiling temperature. The lime protects the cane sugar, but de composes a portion of the uncrystallizable sugar if it be present. Avequin found the scum of the striped sugar-cane of Louisiana, arising from this treatment, to have the following composition:

Gum resembling cherry gum	50.25
Green matter, chlorophyll	10.05
Albumen, with particles of woody fibre	22.78
Phosphate of lime	3.35
Silica	14.07
Total	100.50

This treatment does not remove all of the nitrogenized matters so injurious to crystallization, all of the gum, nor all of the salts.

3. The juice is then (by the improved process) filtered through animal charcoal. This removes a portion of the lime, all of the coloring matters, and certain of the salts, without materially lessening the amount of sugar. Of course all of the solid matters in suspension are removed by the filter.

4. The juice is then again subjected to a boiling temperature, care being taken that enough lime is present to react faintly alkaline. The water is, of course, driven off and the lime *acts upon the nitrogenized substances* at the boiling *temperature* so as to decompose them, which fact is proved by the ammonia given off at this stage of the process. Other substances are at the same time separated, as the scum, which is removed. It is very important to observe that when grape sugar is present the lime decomposes it, and that this action is stronger the higher the temperature of the boiling liquid. Brown compound of lime with the products of decomposition of the grape sugar are thus formed. I believe that this is the source of the difficulty which farmers have had with the sorghum juice, even when lime has been employed for defecation. The juices operated upon *have been rich in grape sugar.* If no lime has been used, the nitrogenized substances are not sufficiently separated; while if lime has been used, it has acted upon the grape sugar to produce an abundance of deleterious substances. In either case there are present at the close of the process substances which stand in the way of crystallization. The best remedy consists in obtaining a cane which produces a juice as free from grape sugar as possible; but at all events care must be taken during the manufacture that the grape sugar shall not be materially increased and the deleterious substances should be as much as possible removed by the use of animal charcoal.

5. The juice must be freed from all matter capable of being removed by animal charcoal, at some point between the evaporation and crystallization. This point is fixed by the degree of concentration which the sirup must have to permit it to flow freely through the charcoal filters. The limit lies between 20° Beaume, (specific gravity 1.16,) as usual in the beet sugar-factories of Germany, and 33° Beaume, (specific gravity 1.295,) which is the practice in France. The second filtration through animal charcoal removes coloring matter, a large portion of the lime, nitrogenized matters, and small quantities of certain salts. It leaves on the juice some organic matter (gum ?) and certain mineral salts. The juice is not subjected to any further purification, but is rapidly boiled down to the point of crystallization.

6. *Boiling down.*—The temperature of the sirup at the commencement of this part of the process is 220½° Fahrenheit, and at the close 266° Fahrenheit. Since the higher the temperature of the boiling sugar the more rapid is the formation of substances injurious to crystallization, according to the improved sugar process, this boiling is effected in vacuum pans, in which the sirup boils at a very low temperature. The time when the boiling shall cease is determined by the temperature, or by certain tests which sugar boilers have discovered. These are: (*a*) *The string tests,* which consists in rubbing a portion of the sirup between the fingers and thumb and drawing out the sirup between them. The thread must attain a certain length without breaking, and the separated parts must stick together uniformly. A moderate thread corresponds to 78 per cent. sugar, and boiling point of 226° Fahrenheit. (*b*) The bubble test consists in dipping a perforated ladle in the sirup, allowing the excess to run off, and then blowing forcibly through the holes, by which bubbles, separating in the form of air balloons, are produced. A well-defined bubble test corresponds to 86 per cent. of sugar, and a boiling point of 248° Fahrenheit. (*c*) In the water test, a drop of sirup is suffered to fall and cool in cold water. It ought to flatten by its own weight, and not adhere to the fingers. When the sirup has been boiled down to the proper consistency, it is removed and placed in coolers, the contents of which are stirred several times. When the temperature has fallen to from 180° to 185° Fahrenheit, the sirup is removed to conical moulds having apertures at the bottom, which are at first closed and then opened so as to permit the molasses to drain from the crystallized sugar. These moulds are kept in a warm room to facilitate the draining, which takes place from beet sugar in twelve or fourteen days. The sugar may be further purified from molasses by the process of claying. This is performed by mixing clay with water, and pouring it on the sugar in the mould. The water from the clay becomes saturated with sugar and drips through the mass of crystals, washing out the greater portion of the molasses. Liquoring is an improvement upon the claying process. It consists in pouring upon the sugar in the mould a saturated solution of refined sugar. The effect is the same in washing out the molasses. Knapp, in describing the beet sugar manufacture, states that "a mould containing from thirty to forty pounds of sugar sirup yields, after liquoring, a solution of sugar at the expiration of ten or twelve days, or when clay is used, in twenty or thirty days, from twelve to fifteen pounds of lump sugar."

I have thus set forth, in general terms, the theory of the sugar manufacture from cane and beets. The sorghum sugar manufacture will require at least as much skill and care as that of the sugar-cane, and probably as much as that of the beet, in order to make it a profitable investment for general use. That these principles are applicable to the new canes is abundantly established by the experiments of that able sugar refiner and scientific man, Joseph S. Lovering. The present high price of sugar enables this skillful treatment of the new canes to be tested practically by men in the west who are investing money in the erection of suitable sugar-houses, containing the proper machinery for manufacturing pure sugar.

Those who treat the juice of the cane upon a small scale, whether for sugar or sirup, will meet with greater success the more closely they adhere to the principles laid down above. The greatest difficulty in their way, as the analyses of the sorghum and imphee canes show very distinctly, arises from the uncertain composition of the juices obtained from the different canes which are grown. Hence we find men who are very successful with certain kinds of cane. These canes, as far as I have been able to test them, do really contain a larger proportion of cane sugar over grape sugar. The great desideratum at present is the best cane. Experiments to be tried by the farmers, in connexion with the analyses of the cane thus grown, will establish this desirable point.

In these agricultural experiments care must be taken to prevent hybridization, so that the seed produced will yield a plant like that analyzed.

Farmers who care to make sirup only may use those evaporators which enable a rapid evaporation of the juice combined with an effective separation of the impurities by skimming. If this evaporation can be preceded by a defecation with lime and heat, in a separate vessel, so much the better; but such defecation should be followed at some time subsequently during the evaporation by a filtration through animal charcoal. If the juice is rich in grape sugar and weak in cane sugar, the addition of lime will give a poorer sirup than to omit it. Careful boiling and skimming is then the best plan to adopt. If, on the other hand, the juice is rich in *cane* sugar and poor in *grape* sugar, a defecation by lime and once (or better twice, as directed above) filtration through animal charcoal cannot fail to reward the farmer with a crop of crystals and with good sirup.

In closing my report, I would remark that the collection in the laboratory of such soils, manures, plants, wines, &c., &c., the analyses of which might prove of general interest to farmers, is gradually increasing, and that I have arranged plans for such analyses.

I am, very respectfully, your obedient servant,

CHARLES M. WETHERILL,
Chemist, Department of Agriculture.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF THE SUPERINTENDENT

OF

THE GARDEN ATTACHED TO THE DEPARTMENT OF AGRICULTURE.

SIR: The date of my appointment to the supervision of the garden of the Department having been so recent, sufficient time has not elapsed to enable me to record the completion of any experiment, or the comparative results of operations now in progress. It may be useful, however, for future reference, to allude briefly to the condition of the garden when placed under my charge.

In the first place, I may state that no books or papers of records have been placed in my hands, consequently I have no means of determining the sources from which many of the plants have been obtained. This, although a point of slight importance, perhaps, with regard to genera and species, is extremely important when we come to varieties of plants adapted either for utility or ornament.

We are thus, also, left in ignorance of the objects for which many of the plants have been cultivated. Such plants as the Candleberry Myrtle, Japan Cedar, Carob Plant, Christ's Thorn, Date Palm, Hop Tree, Indian Shot, Acacia Julibrisson, Oleander, Serissa fœtida, Bryophyllum Calycinum, and Prickly Pear, &c., &c., of which thousands have been propagated, cannot certainly be considered as worthy of special attention further than they might contribute to a botanical collection, which, however desirable, is not the present purpose of this garden.

Special attention has been very properly directed to the formation of a complete collection of the improved varieties of native grapes. The list shows a very valuable assortment of 120 varieties, and from these a large number of young plants have been propagated, and are now in the garden; but (with the exception of a few kinds that have been determined) no reliance can be placed on the accuracy of their names. A large portion have only numbers attached, and all efforts to discover the reference to these numbers have been futile, consequently they are of no value either for distribution or propagation. An entire new collection has been commenced, and about sixty varieties have already been received from reliable sources.

The soil of the garden is in the main of a good quality, requiring, however, a thorough course of ameliorative culture and manuring. About one-half of the surface was occupied in grass, which is being put under culture. Some alterations have been made in the walks, and other changes are in progress with a view of affording greater facilities for cropping the ground.

There are two glass structures, each 100 feet in length and 25 feet in width. These are good, substantial houses, well fitted and adapted to plant culture. Some improvements were found necessary in the heating apparatus, which has been effected. A portion of one of these houses has been altered and fitted as an exotic grapery. I have had the vines planted, the object of the alteration being for the purpose of showing how easily this fruit may be produced.

For the purpose of comparing the relative value of our native grapes additional trellises, to the extent of 3,000 square feet, are in course of erection. These are of various designs, in order to test their respective merits.

As a commencement towards establishing examples in fruit culture, a collection of pear trees was planted early last November. These comprise sixty varieties of approved sorts, and, in order to exhibit the relative merit of *stocks*, one plant of each kind is grafted on the quince root, and one of each on the pear. These were procured from a reliable source, are true to their names, and form a selection of much value and interest.

With reference to future operations I beg to introduce the following remarks on the objects and aims of the Experimental Garden:

In offering the following suggestions it is to be understood that only a few of the primary and most prominent objects of the garden are brought under consideration. No definite limits can be given as to the extent, neither can any restrictive rules control all the details of such operations; these are as various and boundless as are the objects to which they are directed:

1. To procure and encourage the transmission of seeds, cuttings, bulbs, and plants from all sources, both foreign and domestic, for the purpose of testing their merits and adaptation in general, or for particular localities of this country.

2. To procure, by hybridizing and special culture, products of a superior character to any now existing.

3. To ascertain, by experiment, the influences of varied culture on products, and the modifications effected by the operations of pruning and other manipulations on trees and fruits.

4. To investigate more thoroughly the various maladies and diseases of plants, and the insects that destroy them.

5. To provide ample means for thoroughly testing samples of all seeds and other contributions that may be received.

6. To cultivate specimens of the various hedge plants, and exhibit their availability for that purpose.

7. To cultivate a collection of the best fruit trees and plants, such as grapes, apples, pears, peaches, strawberries, raspberries, currants, &c., so as to compare their respective merits.

8. To plant a collection of choice shrubs, adapted for decorating gardens and landscape scenery.

9. To erect glass structures for the twofold purpose of affording the necessary facilities for cultivating exotic fruits and plants and to furnish examples of the best and most economical modes of constructing, heating, and managing such buildings.

These propositions comprise some of the most obvious objects claiming immediate attention; a recapitulation, with further explanatory remarks, may be offered.

1. TO PROCURE AND ENCOURAGE THE TRANSMISSION OF SEEDS, ETC.

The collecting of seeds and plants is one of the most important matters. No doubt there are in various countries numerous useful vegetable productions not yet introduced that are capable of reaching their highest state of development in some one or other of the various climates of this. It is worthy of consideration whether future efforts would not be rendered more directly useful by issuing letters of instruction to foreign representatives and correspondents, enumerating such seeds and plants in their respective localities as may, in the opinion of the Department, be most worthy of experiment. With such advice it is reasonable to hope that much of the disappointment consequent upon indiscriminate collection may be avoided, and only such products introduced as present, at least, plausible expectations of utility.

The efforts of the Department would be greatly strengthened in this respect, and its area of usefulness vastly extended, if all who were possessed of new or rare seeds and plants would co-operate by transmitting samples for investigation. Many persons throughout the country occasionally receive plants and seeds from distant correspondents, and, not having facilities for their proper cultivation, they are consequently lost. It would be highly advantageous for the Department to encourage the reception of such favors, have them carefully noted, their merits properly investigated by competent cultivators, the result made known to the donors, and such disposition made of them as would be considered most advantageous.

2. TO PROCURE, BY HYBRIDIZING AND SPECIAL CULTURE, ETC.

The improvement of vegetable races by hybridizing and cross-breeding is at once the most direct and important means which we possess in modifying and adapting them to special purposes. The field of experiment here is boundless, and some sections of it have, so far, scarcely been trod upon. The improvement of various fruits, and their better adaptation to domestic purposes, present enticing inducements to the experimentalist. It may safely be assumed that none, even of our most valuable and oldest varieties of fruits, have attained that degree of excellence to which they may be brought; neither do they afford the variety nor continue their season of productiveness, to the extent which is evidently possible. We have fruits that individually possess desirable properties, but associated with qualities that equally tend to depreciate their merits; and, from the experience derived from former efforts, there is abundant evidence for encouragement in our efforts to produce a variety invested with a combination of excellencies not individually attained. Let us take, for example, that universally admired fruit, the strawberry, and originate a kind combining the wonderfully hardy and productive powers of the "Albany," the stately growth of the "Fillmore," and the exquisite delicacy of flavor found in the Vicomptesse Hericaurt de Thury, and we might gratify ourselves with the possession of a plant approaching closely to perfection in this fruit. The grape, of all other fruits, offers great promise to the hybridizer. A good wine grape is yet a desideratum, and every attention should be directed to the production of a grape that will possess the necessary peculiar characteristics for this purpose.

There is scarcely a limit to the objects presented to the hybridizer for experiment. To increase the size and color of flowers; to improve the flavor of fruits by changing austerity and acidity into sugary matter; to increase the hardiness of tender plants and make barren races productive; to extend the season of productiveness by hastening the maturity of some and retarding that of others, are only a few of the many improvements awaiting the systematic efforts of the hybridizer.

It is true that in many cases the operation is somewhat difficult to perform, and in all a delicacy of manipulation is required which tends to prevent experiments of the kind from becoming general, but carefully conducted operations will certainly be followed by valuable results.

3. TO ASCERTAIN, BY EXPERIMENT, THE INFLUENCE OF CULTURE, ETC.

To establish definite systems of culture; to ascertain how far certain desirable results can be influenced by pruning, how and when it is beneficial and when injurious; to institute carefully concerted experiments with a view of discovering to what extent the mere physical or mechanical condition of a soil affects its capacity of production, and how much is dependent upon its chemical constitution for the highest development of the cereals and fruits, opens up a line of inquiry by which valuable truths may be reached. The exact specific relation that exists between the soil and its vegetable productions, and the special appliances to render plant food soluble and in a condition available to the purposes of vegetation, are subjects upon which many opposite and seemingly conflicting opinions exist.

In this connexion, also, the application of manures, the kinds to be employed, and the time and manner of their use, whether as surface dressings, or by an intimate mixture with the soil, present a series of questions well known to be of vital importance, and of which much yet remains in obscurity.

4. TO INVESTIGATE MORE THOROUGHLY THE VARIOUS MALADIES AND DISEASES OF PLANTS, ETC.

The diseases of plants are now attracting much attention. It is notorious that much of the difficulty now experienced in the production of fruits is, in a great degree, due to the prevalence of various maladies in trees. Thus, we have to contend with the yellows of the peach and nectarine, as well as the so-called blister of their leaves in spring; the cracking and spotting of the fruit of the pear and apple, and the blighting of their branches, and the mildew and rot of the grape and gooseberry. How far these affections may be induced by deficiencies or repletions in the soil, or how much of their virulence is due to local position in connexion with atmospheric currents, has yet, in the majority of cases, to be determined.

Insects, also, beset the cultivator on every side; these are insidious and powerful opponents, requiring close study, minute and patient observation, in order to learn their habits, and adopt effectual means for their extermination. Experiments tending to the elucidation of these subjects are now in progress, and their further investigation will receive attention as soon as means will allow.

5. TO PROVIDE AMPLE MEANS FOR TESTING SEEDS, ETC.

The necessity for testing seeds and plants is one of the most obviously useful, as it has been one of the most assiduously and successfully conducted operations of the garden. Increased facilities for extending these tests have become necessary, especially with reference to agricultural seeds, roots, and tubers. Comparative results can only become definite and reliable when attained under similar circumstances. To ascertain whether one variety of plant is earlier, hardier, or more productive than another, it is necessary that

they should be cultivated under the same conditions of climate and soil. When it is impracticable to procure other than small packages of new and choice articles, the purposes of distribution will be greatly enhanced by their previous increase. By this means a knowledge would be gained of their value which might prove of much moment. The necessary requirements for testing the products of hybridization further point to the paramount necessity of the Department having at its disposal greater facilities than the present garden affords, and where the more extended and economical operations of field culture may be introduced.

6. TO CULTIVATE SPECIMENS OF VARIOUS HEDGE PLANTS, ETC.

The subject of live fences is one of vast import alike to the agriculturist, horticulturist, and pomologist. The heavy investments annually incurred in the erection and repairs of fencing has long been a matter of serious consideration, and the introduction and culture of hedges has in some quarters occupied much attention and been extensively adopted. Orchardists and gardeners are gradually awakening to the conviction that shelter is one of the most necessary appliances conducive to the health and earliness of their crops. The dry, frosty breezes of early spring are especially pernicious, and their effects lay the foundation for many plant diseases. On the western prairies, particularly, it may be questioned whether successful fruit culture will be realized in the absence of shelter from exhausting winds.

Then, again, for the purpose of forming neat boundary and dividing lines in pleasure grounds and gardens no fence is so beautiful, and, when proper plants are selected for it, no barrier so effective and permanent. As examples of what may be done, and how best to do it, specimen hedges should be established, showing the relative merits of various plants for the purpose, both deciduous and evergreen; this would afford demonstrative evidence far more satisfactory and conclusive than can be conveyed by any amount of mere descriptive advice.

7. TO CULTIVATE A COLLECTION OF THE BEST FRUIT TREES, ETC.

It is known that our lists of fruit trees have reached an extent that renders it a matter of much perplexity to select those best suited for particular purposes. Tastes vary widely in this respect, and, happily, Nature has provided so ample a variety that all may be gratified. With a view to assist in the selection of sorts, specimen orchards should be established, consisting of a discriminate collection of the acknowledged best fruits, as far as they are known, in each class. In order to make this result more immediately effective, advantage should be taken of the valuable labors of the American Pomological Society in making a selection of sorts.

There is every reason to believe that plantations of this description will be of great service to all who contemplate planting fruit trees. The relative merits of sorts, both as regards the intrinsic qualities of the fruit and the productiveness of the plant, as well as the general appearance and habit of growth, hardihood and freedom from disease, would here be exhibited. The modifying influences of culture in training and pruning, already alluded to, should here receive prominent attention. From such a source facts of the highest value would be demonstrated.

8. TO PLANT A COLLECTION OF CHOICE SHRUBS, ETC.

Every one will admit that the embellishment of dwellings and their surroundings has an ameliorating effect upon the habits of the occupants. It is also well known that many persons are deterred from undertaking this kind of improvement owing to their inability to decide upon the kind of plants and shrubs

that would prove most satisfactory. A choice collection of hardy shrubs should therefore be cultivated, and if arranged so as to produce landscape effect, those who contemplated landscape improvements, and, indeed, all who felt desirous of studying the various forms and peculiarities of this family of plants, with a view of becoming familiar with their adaptabilities, either as isolated plants for particular positions or the general effect produced by combined masses, would here find instructive examples.

9. TO ERECT GLASS STRUCTURES, ETC.

The opinion is by far too prevalent that glass houses for the accommodation of plants or the culture of fruits are expensive luxuries within the reach of a comparative few. Nothing can be further from the truth; the pleasures as well as profits to be derived from an exotic grapery are so great, the expense of erection so moderate, and, withal, the general management so simple and so easily acquired, that it should form an adjunct to every country residence. Even in the limited area usually allotted to city dwellings a small grapery can be established where little else can be cultivated. It would be a duty worthy the attention of the Department to show how to build such structures cheaply, and systematize and popularize a mode of management within the capacity of all to understand.

The trouble connected with raising hardy fruits, such as the plum, apricot, and nectarine, in some districts, has led to the culture of these fruits under the protection of glass houses, where a family supply is as certain as a crop of corn. The amount of fruit thus grown in a limited space is truly surprising. Successful examples of this and other projects cannot fail in conveying instruction and effecting an economy of time, labor, and money.

There is much yet to be demonstrated in the form, materials employed, ventilating, heating, and general arrangement of glass structures.

All of which is respectfully submitted.

WILLIAM SAUNDERS,
Superintendent of Experimental Garden.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORTS AND TABLES OF AGRICULTURAL STATISTICS.

SIR: The accompanying reports and tables of agricultural statistics of the crops of 1859 and 1862, and of the agriculture of California, are laid before you for publication in the agricultural volume for 1862. The census returns for 1860 having been published, it is due to agriculture that at the earliest moment the returns of the principal agricultural products should be republished in the annual report of the Department of Agriculture. The reports accompanying the tables have been prepared in the hope that they would serve to give greater interest in the tables. Any inaccuracies which may be found, must be attributed to the yet imperfect manner of collecting statistics, and to want of time and means for verifying them.

AGRICULTURAL STATISTICS.

THE tables of agricultural statistics which follow this article are taken from the census report for 1860. Our decennial census embodies much that is instructive. The agriculture of the United States, either as to its amount or the variety and importance of its productions, is without a parallel. The changes it is undergoing, and the causes producing them, cannot but be deeply interesting to all, but more especially to the manufacturing and commercial interests, the prosperity of which is so completely dependent on the progress of agriculture.

The reader will see that these tables give the agricultural statistics of the loyal and disloyal States separately. The year of the rebellion followed that in which these statistics were taken. This fact, therefore, naturally suggested the utility of exhibiting their absolute and comparative progress, that the world might judge how far this rebellion was justified by any want of prosperity in the south, indicative of grievances that demanded redress.

The object of this article is to show the vastness of American agriculture, the changes it is undergoing, the causes of these changes, and the progress made by the loyal and disloyal sections of the Union in their agricultural industry. That object will be best accomplished by a brief consideration, separately, of the leading products of our agriculture.

ANIMAL STOCK OF THE FARM.

The northern States are grass-growing, and hence we might expect that their farm stock would exceed that of the southern States. As a general fact this is the case, and the per cent. increase is greater in the former. Still, some of the latter have good grass localities, as Virginia, and the climate of others is excellent for particular species of farm stock, as Texas for sheep. The population of the loyal States is about 59 per cent. and of the disloyal States about 41 per cent. of the whole amount. The entire number of horses, mules, cattle, sheep, and hogs is 95,831,960, and of this number 58,722,112 are in the loyal States and 37,119,848 are in the disloyal States. The former have 60¾ per cent. of the whole number, and the latter 39¼ per cent., being nearly in the same ratio as population, but much of the population of the loyal States is engaged in manufacturing and commercial pursuits.

The increase of farm stock during the decennial period from 1850 to 1860 is greater in the loyal States, as will be seen from the following table:

	Loyal States.			Disloyal States.		
Horses	84	per cent. increase.		39	per cent. increase.	
Mules	170	"	"	115	"	"
Cattle	60	"	"	52	"	"
Sheep	$2\frac{1}{2}$	"	"	$37\frac{1}{2}$	"	"
Hogs	32	"	"	6	"	"
Total	$348\frac{1}{2}$	"	"	$249\frac{1}{2}$	"	"

The increase in the *value* of live-stock and in slaughtered animals is also in favor of the loyal States:

	Loyal States.			Disloyal States.		
Live-stock	$103\frac{1}{2}$	per cent. increase.		101	per cent. increase.	
Slaughtered animals	106	"	"	93	"	"
Total	$209\frac{1}{2}$	"	"	194	"	"

The prosperity of both sections of the Union in this branch of husbandry has been most satisfactory, more especially of the south, when its general unfitness for grass production is considered. The animal production of the country has been as great as it could profitably have been. If much of its industry has found greater encouragement in other branches of agriculture, it has been advantageous to animal production, as the greater per cent. increase of its value over that of its numbers indicates. It will presently be seen that this increased value cannot be attributed to an undue expansion of the paper currency, but to the general progress of the country in its industrial pursuits.

THE CORN CROP.

Corn is justly regarded as the national crop of the United States. Its money value is double that of hay, threefold that of wheat, and fourfold that of cotton. In 1850 the amount of the corn crop was 591,630,564 bushels, and in 1860 827,694,528 bushels—an increase of 39.90 per cent. Of these crops the loyal States produced as follows:

1850	351,420,821	bushels.
1860	547,029,514	"

Being an increase of $55\frac{5}{8}$ per cent.

The disloyal States produced—

1850	240,209,743	bushels.
1860	280,665,014	"

Being an increase of $16\frac{4}{5}$ per cent.

The amount of this crop to each of these sections of the country is in nearly the same ratio as population, but in the disloyal States the *increase* is much below it. Their ratio of population is $39\frac{1}{4}$ per cent., and their increase of the corn crop but $16\frac{4}{5}$ per cent. The cause of this will be found in the greatly enlarged production of cotton; and the chief part of the increase in corn is in the States of Arkansas and Texas, which are large growers of farm stock in the southern States.

Although the exportation of corn is considerable and increasing, yet it is a question of rational doubt whether this export trade is desirable. Corn constitutes too great an element in the raising and fattening of our farm stock to permit its price to be advanced by exportation. If this exportation could be

sustained by a corresponding reduction of the amount consumed in distillation, no more desirable change could be wished. An export trade of a cereal so exhausting to the soil results in ultimate injury, and nothing but feeding our corn crop at home, especially by hogging down, has kept up our corn lands generally to their present fertility. Too much of it already has shared the fate of the Virginia tobacco lands.

WHEAT—ITS PRODUCTION AND EXPORTATION.

Not less satisfactory is the general increase of the wheat crop. It is nearly 70 per cent. between 1850 and 1860. The crop in 1850 was 100,164,350 bushels, and in 1860 170,170,027 bushels. Of the latter amount the loyal States produced 138,809,133 bushels, being 81 per cent. of the whole crop; the disloyal States raised but 19 per cent. of it, that is, 31,366,894 bushels.

The existing rebellion demands that we should look at the corn and wheat crops together. From the corn is produced most of our meats. Unitedly they form the breadstuffs and meats which now have such a controlling influence at home and abroad. Unitedly, too, they stand arrayed against the kingly prerogatives of cotton, and, therefore, against that rebellion which seeks to overthrow a Union which, so wisely and advantageously, has heretofore bound together in peace all interests.

The great staple in our exportation of breadstuffs is wheat. For the two years of 1861 and 1862 our exports have been—

		Value.
Wheat, bushels	68,529,629	$81,416,919
Flour, barrels	9,205,789	52,180,522
Total value		$133,597,441

The exportation of wheat and flour to Europe has continued to increase for many years, until it is certain that its dependence on us is permanent varying, of course, as to the amount, according as the crops of Great Britain and the continent may be greater or less.

In the article on the wheat plant published in this Report there will be found an examination of the important question, From what source and to what extent may this European demand be supplied by other nations? In addition to what is there said, the following view presents itself from the latest sources of information.

The only nation that can ever become a competitor with the United States in supplying this European demand is Russia. The following account of the grain production of that country is taken from a communication of F. S. Claxton, our consul at Moscow, addressed to our government in 1861:

"The great grain-growing district of Russia, whose annual yield is sufficient for the wants of the European continent, lies to the south of its centre, and between the fortieth and seventieth degrees of east longitude. It comprises the governments or provinces of Volhynia, Poltava, Kiev, Podolia, Karkow, Voronegh, Saratov, and Samara. It may be considered as a tract of land over twelve hundred miles long by about four hundred broad.

"The grain fields extend uninterruptedly for hundreds of square miles; and hour after hour, though whisked along with the best speed of four horses, nothing can be seen, on the road from Koorsk to Kuminchuk, but endless seas of rustling wheat or tall, waving rye. Many times during the trip I availed myself of some trifling elevation, and from the top of the vehicle obtained an uninterrupted view of the whole country embraced within a horizon at least twelve miles distant; yet the whole of the many thousands of acres thus spread out presented but one gigantic patchwork of yellow wheat and greener grain not then ripe for the harvest, and the whole scene, though devoid of all beauties of landscape and undiversified by hill or valley, without a forest or even a clump of trees to catch the eye, yet was so wonderful a picture of a nation's wealth and resources that I could not restrain a transient feeling of national envy and jealousy."

Of the cultivation, harvesting, and threshing he thus speaks:

"When I beheld the primitive plough with which the land is opened, and which scarce penetrates the surface, and certainly does not open a furrow much wider than one's hand, and when I witnessed the slow process of cutting the grain with the long since abandoned sickle of about two and a half feet in length, I could not but conjecture that with improved implements, such as yearly compete for the prizes at our State fairs, the return from the land must be largely increased, whilst the labor of harvesting the crop will be reduced in still greater proportion. Again, the present process of threshing results in great loss; for, if the operation is performed on a large scale, the grain is scattered over an enclosure into which are turned the almost wild horses of the steppes (prairies)—a drove of which is usually attached to each estate—and it is by their trampling hoofs, whilst urged here and there by the cries and long whips of the attendants, that the wheat and rye are separated from the straw."

Besides the district here described, which is in Little Russia, there are excellent wheat lands in Poland. The port of Odessa, on the Black sea, is the shipping point for Little Russia. The cost, and other matters attending the transportation, should be considered also:

"The voyage from Odessa [says Mr. Homans, in his Cyclopedia of Commerce] to Britain is of uncertain duration, but generally very long. It is essential to the importation of wheat in good condition that it should be made during the winter months. When the voyage is made in summer, unless the wheat be very superior and be shipped in exceedingly good order, it is almost sure to heat, and has sometimes, indeed, been injured to such a degree as to require to be dug from the hold with pickaxes. Unless, therefore, means be devised for lessening the risk of damage during the voyage, there is little reason to think that Odessa wheat will ever be largely imported into Great Britain."

The price of wheat on shipboard at Odessa he places at 40*s.* a quarter, and the cost of shipping to England 16*s.* a quarter, making the entire cost $1 44 per bushel of 60 pounds.

Corroborative of these statements as to the dangers of a long sea-voyage, is the remark of the Chicago Board of Trade relative to the injuries to our own wheat when shipped to England by New Orleans. They say:

"The heated waters of a tropical sea, destructive to most of our articles of export, and a detour in the voyage of over three thousand miles in a direct line to the markets of the world—these considerations have been sufficiently powerful to divert the great flow of animal and vegetable food from the south to the east. Hence the lake, and canal, and railroad transportation to New York, in preference to the cheaper but longer route to Great Britain by New Orleans."

These facts show that however great may be the capacity of Russia to grow wheat, that nation will not become our rival in supplying the English demand for breadstuffs.

TOBACCO—ITS INCREASE AND FOREIGN TRADE.

The cultivation of tobacco exhibits an increase far beyond the usual augmentation of our crops. In 1850 the number of pounds raised was 199,736,336, and in 1860, 429,364,751 pounds; an increase of 115 per cent. Of the crop of 1860, the loyal States produced 230,343,321 pounds, and the disloyal States 199,021,430 pounds. This gives the former 53½ per cent. of the entire crop, and the latter 46½ per cent., which is less to the loyal States than their ratio of population by 7¼ per cent. But the per cent. increase from 1850 to 1860 is more equal, it being 112 per cent. in the loyal, and 118 per cent. in the disloyal States. Such an increase is remarkable, and it becomes an important question to determine how far an increase on the product of 1860 can be sustained? To answer it requires a brief notice of the foreign trade in our tobacco.

Our exports of unmanufactured tobacco have been as follows:

1855	$14, 712, 468
1856	12, 221, 843
1857	20, 260, 772
1858	17, 009, 767

1859	21,074,038
1860	15,906,547
1861	13,784,710

This table shows a general but irregular increase, until disturbed by our political difficulties. From 1855 to the close of 1859 the exports increased about six and one-third millions dollars, or, in pounds, from about 140,000,000 to 210,000,000. The crop of 1859 was 229,638,116 pounds more than that of 1849, and of this we exported about 70,000,000 pounds, leaving for increased domestic consumption during these ten years 154,638,116 pounds. The increase in the home consumption had, therefore, more than doubled the increase in the exports.

The increase in tobacco between 1850 and 1860 has been, in the loyal States 121,568,415 pounds, and in the disloyal 108,060,001 pounds. It is a crop, therefore, in which all States have an interest, and which seems well adapted to almost every climate of the United States.

That the increasing home demand can sustain a like future increase cannot be expected. How far we can rely on an increasing foreign consumption of our tobacco can be seen from the following table, showing the amount taken by several nations, and the revenue they derive from duties and internal taxes on American tobacco:

	Quantity.	Revenue.
Bremen	38,058,000 pounds	$16,652
Great Britain	24,203,000 pounds	18,297,468
France	40,866,000 pounds	16,000,000
Holland	17,124,000 pounds	21,695,000
Spain	7,524,000 pounds	4,600,000
Belgium	4,010,000 pounds	33,749
Sweden and Norway	1,713,000 pounds	88,505
Total	143,498,000 pounds	$60,691,373

The average duties and taxes amount to something more than 50 cents a pound. Great Britain levies a duty of 72 cents per pound and 5 per cent. additional on the leaf, and $2 16 per pound and 5 per cent. on manufactured. France derives a clear revenue from its government monopoly of 33 per cent., and Austria of 76 per cent. In 1859 we exported to Austria over five millions of pounds.

The above table presents a general average of the revenue derived by foreign nations from our tobacco. Assuming our exports of the crop of 1859 to have been 210,000,000 pounds, their revenue upon it would be $88,825,609. What our exports would become if these monopolies were broken down can readily be seen.

These statistics indicate that the domestic consumption of tobacco has increased enormously. That it can continue to increase in the same ratio to population, or anything like an approximation to it, is almost impossible. We may hence infer that when our agricultural industry resumes its old channels by the restoration of peace, tobacco cultivation cannot be profitable in the southern States to the extent of their production in 1859, and in the loyal States to the extent of its present cultivation by them. Nor have we any hope that foreign governments will modify their monopolies and duties, for Congress in 1859 fruitlessly sought such a change.

COTTON AND WOOL.

These constitute the cheap textile materials of our country, and to a great extent have been antagonistical to each other; hence, I consider them in connexion.

Cotton advanced from 2,445,793 bales of 400 pounds each, in 1850, to 5,192,746 bales in 1860; an increase of 213 per cent. Is it any wonder that this product, like individuals too prosperous, claimed kingly prerogatives to itself? As it belonged wholly to the disloyal States, its increase is due to their credit alone. Of this product 3,812,345 bales were exported in 1860, leaving 1,384,599 bales for domestic consumption. It was upon the labor bestowed on this exported cotton that these prerogatives were based; but after all, this labor was bestowed upon it for the purpose of getting its bread, and this bread, more essential to life, won the victory in the strife for royal supremacy.

Almost the only agricultural product that has not greatly increased during the last census decade is wool, although it is one of the most useful. Its increase in this period is but 7,994,384 pounds, being but 16 per cent. Two causes have produced this result—the great consumption of foreign woollen cloths and the substitution of cotton fabrics for woollen. Even in the manufacture of our woollen cloth, about sixteen millions of pounds of cotton have been annually used.

But the rebellion is giving to wool-growing an impetus it would never have received if peace had continued. The amount produced in the several States in 1860 was 59,932,328 pounds, of which the disloyal States raised 9,748,702 pounds, leaving 50,183,626 pounds as the wool product of the loyal States.

What is the present amount of wool, and how far can the present rate of increase of sheep be sustained?

By the census of 1860 the whole number of sheep in the United States is 24,823,566; but to ascertain the present condition of the wool market, the sheep of the loyal States only should be considered. These were, in 1860, 17,198,219; from which one million should be deducted for the destruction by war of those in Kentucky and Missouri. The returns to this Department for 1863 state the increase of the sheep for this year at 25 per cent. Allowing the same increase for 1861 and 1862, the number of sheep in 1861 would be 20,248,024, and in 1862, 25,312,530. This is the number that gave the clip for 1863.

The number of pounds of wool to each sheep is variously stated. The census of 1850 places it at 2.42 pounds; that of 1860, at 2.55 pounds. But in 1860 the sheep of the loyal States yielded 2.92 pounds, whilst those of the disloyal States gave but 1.59 pounds. The following table will show the probable yield in the chief wool-producing States of the north. It is taken from the census returns of 1850 and 1860, and from returns to this Department for 1863:

	1850.	1860.	1863.
New York	2.91	3.60	3.80
Pennsylvania	2.45	2.82	3.33
Ohio	2.58	3.35	3.53
Michigan	2.73	2.61	3.67
Vermont	3.35	4.02	4.54
Indiana	2.32	2.29	3.46
Illinois	2.40	3.06	3.84
Iowa	2.49	2.32	3.47
Average	2.65	3.01	3.75

At three pounds per head, the clip of wool for 1863 would be 75,931,590 pounds; and at three and a quarter pounds, which is probably nearer the actual yield, the clip would be 82,259,222 pounds.

The importation of unmanufactured wool in 1862 was about 60,000,000 pounds, and of manufactured about 40,000,000 pounds. The domestic wool of last year was 60,744,072 pounds at 3 pounds per fleece, or 65,806,078 at

$3\frac{1}{4}$ pounds. The entire wool consumed for 1862 would, therefore, be 160,744,072 pounds to 165,806,078 pounds, being more than double the clip for 1860. Our present wool product may therefore be nearly doubled so long as the supplies of cotton are cut off by the war.

The anti-slavery sentiment of the country will, perhaps, find as conscientious and as effective opposition to slavery, by a less encouragement of its productions, as in any other way. The return of peace should not result in a materially lessened consumption of woollen cloths, but the fashions of the country should adhere to the elegant, light, and healthy woollen goods now in general use for summer clothing. A branch of agricultural industry so beneficial in every respect as wool-growing should receive every encouragement. Wool is better adapted to the wants of our climate, both in summer and winter, than cotton or linen, and mutton is the cheapest of all our meats. No animal is so beneficial to the farm, both in enriching it and keeping it clean of weeds, briers, and undergrowth.

SORGHUM MOLASSES AND SUGAR.

The new product of sorghum cane has established itself as one of the permanent crops of the country. The introduction of the Chinese and African canes was at a most auspicious period, for it enabled the interior States to supply themselves with a home article of molasses, thereby keeping down the prices of other molasses from any great advance over former rates, which otherwise would have been a result of the war. The Louisiana cane molasses in 1860 was 16,313,903 gallons, and the sorghum 7,176,042 gallons. The increase of the first was but 4,277,197 gallons over the product of 1850, clearly showing that it was incapable of supplying the rapidly increasing consumption of molasses. The amount of sorghum molasses was doubled in 1862; and from reports received at this Department, the crop of 1863 will be at least 25 per cent. greater than that of 1862.

The statistics of the Department show that ten of the States are producing sorghum molasses in large quantities, at an average yield of $148\frac{1}{2}$ gallons to the acre, (a too high estimate, however,) which sells at an average price of 52 cents per gallon. The yield of 1863, with a favorable season, will not be under twenty millions of gallons. But the extent of this crop will be governed very much by the success of the northern cane as a sugar-making plant. Everything is favorable to that success, as will be seen from the report of the chemist of this Department as well as from the numerous specimens of sorghum sugar forwarded to it.

Nor is there any nation so much needing a sugar-making plant that may generally be grown, as the United States. This will be seen from the following statistics of the amount of molasses and sugar consumed in it:

IMPORTS OF MOLASSES AND SUGAR.

	Molasses, (gals.)	Sugar, (lbs.)
1856	23, 617, 674	545, 262, 754
1857	32, 705, 844	777, 063, 185
1858	24, 566, 357	519, 240, 945
1859	32, 818, 146	655, 868, 415
1860	30, 922, 633	694, 879, 785
1861	29, 941, 397	807, 938, 946

The domestic molasses and sugar from the Louisiana cane are about 16,000,000 gallons of the former, and about 300,000,000 pounds of the latter, making the annual consumption about *forty-five* million gallons of molasses, and about one billion pounds of sugar. This amount is almost incredible.

Comparing the sugar of the first three years, in the above table, with that of the last three, we find the increase has been eighteen per cent. The ratio of population and the increase of the consumption of sugar is as follows:

	Population.	Sugar.
1840 to 1845	16 per cent.	50 per cent.
1845 to 1850	16 per cent.	34 per cent.
1850 to 1855	16 per cent.	100 per cent.
1855 to 1860	15 per cent.	43 per cent.
Total	63 per cent.	227 per cent.

The consumption per head in 1840 was about sixteen pounds, and now, deducting the slave population, it is about thirty-nine pounds. And this is not an approximation to the amount it would be, if a cheap and home-made article was accessible to all.

These statistics show the great inducements that exist to stimulate the farmer and the sugar-refiner to continued exertion for the complete success of the northern cane.

THE HAY CROP.

The hay crop of 1850 was 13,831,558 tons; that of 1860, 19,073,726 tons, an increase of thirty-eight per cent. Of this last crop the loyal States produced 18,004,443 tons, and the disloyal 1,069,283 tons. Most of the south does not grow grasses for hay, because much of its stock can winter without it, and the remainder needs but little. Thus in Texas and Arkansas, which produce much stock, there is scarcely any hay harvested. Still there is considerable hay sent from the west to southern cities. But greater attention had been given to this product in the south than formerly, for its increase between 1850 and 1860 was 48½ per cent. And this increase is a general one in the southern States.

But in the north the hay crop is second to the corn crop only, being double in value the cotton crop. Its long winters demand a bountiful supply of it for all farm stock except hogs. A comparison, therefore, between the increase of this stock and the hay crop will not be without interest.

The increase in the last census decade in farm stock consuming hay, in the loyal States, is 316½, and in the disloyal 243½ per cent.; whilst that of hay is but thirty-six per cent. in the former, and 48½ in the latter. These statistics present a remarkable difference, and show at a glance that there is a large amount of foddering substances besides hay consumed, and which does not appear in the census statistics. This is true, and they will be found in the corn fodder and wheat and oats straw. The cut-up cornfields and the large wheat straw stacks of the west form a striking feature of western farming. The droughts of summer often cut short the meadows, and when this is the case, the farmer always protects himself from want by the fall cutting up of his cornfields. And this supply is at all times desirable, for the heating and binding, but nutritious timothy hay is tempered in its ill effects by the aperient and cooling properties of the corn fodder and wheat straw.

DESTRUCTION OF THE SOIL.

Whilst our national pride is gratified in contemplating such a greatly increased production, it must occur to every reflecting mind that under our present mode of agriculture, it may be at the expense of the soil. But few greater calamities could befall a nation than the impoverishment of its lands.

Virginia stands as a lesson to the other States. Her unskilful tobacco cultivation ruined the finest portions of her territory. As in Palestine and other countries of the east, now barren from the destruction of their soil by reckless cultivation, our lands once destroyed remain so, and thus the territorial limits of our States are in fact diminished. Nations wage wars in vindication of their right to a few acres, but permit the destruction of many from want of knowledge in the farmer.

In the absence of an account in the census returns of the acres of pasture lands and of the ploughed acres, it is difficult to determine the extent of the deterioration of our soils by these immense annual crops. It must be great. Still we know that our agriculturists are aware of this evil, and that the use of fertilizers is rapidly increasing. The columns of clover seeds and grass seeds give some evidence of this. The increase of clover seeds during the last decade has been one hundred per cent., and of grass seeds one hundred and sixteen per cent. This would have added not less than twenty-six millions of acres to our pasture and meadow lands, had it not been for the greatly increased exportation of seeds. This exportation was but $13,570 in 1855, and in 1861, $1,063,141; but in 1862 it fell as low as $299,255. The increase of our improved lands from 1850 to 1860 has been about fifty millions of acres; that of clover and grass seeds should have been sufficient to have seeded that number of acres.

DOMESTIC MANUFACTURES.

The domestic manufactures appear to decrease with the increase of those made by machinery. In 1840, the value of these was $29,023,380; in 1850, $27,484,144; and in 1860, $24,226,461. This decrease has been much greater in the northern States than in the southern and new States.

The cause which leads to this result is the increase of general manufactures, which have a twofold operation. They cheapen articles of apparel below the price that governs the value of home manufactures, and give so great a demand to garden and farm products, that may be produced by the female portion of the household, that their labor is given to these.

The prevalence of home-made manufactures is indicative of a want of market facilities, such as exists in the new States, and an absence of manufactures by machinery, such as characterizes the southern States. Still it is questionable whether the decline of home manufactures is a good, either to the public or the household. A dependence on the store for wearing apparel begets extravagance in dress, and a dependence, too, on dressmakers and others. It is now not uncommon, in towns as well as in cities, to find the female portion of the household unable, and also unwilling, to make up their own dresses, or any portion of that of the male part. Every right-thinking person must regret such a consequence of the decay of household manufactures, for the phases of American life are too changing to permit an ignorance of household duties, and the ability to personally discharge them under all circumstances, either of necessity or proper economy.

This decrease will be temporarily checked, at least, by the war, for the high prices of cotton and wool have so advanced the prices of manufactures generally that home-made goods now once more resume their former economical value.

INFLUENCE OF RAILROADS UPON THE VALUE OF FARMS.

The progress of our agriculture is best seen in the column representing the cash value of farms. Their increased value is evidently greater than the augmentation of the crops would justify. That the farmers have given much

of their gains to making railroads and other commercial highways is known to those familiar with the progress of these roads. This investment has been returned to them, and is found in this column. The increased value of farms has been 103 per cent., or $3,370,534,976. This is enormous.

A similar increase from railroad investment will be found also in the great increase of the value of stock and crops. Distant markets have been brought near, and hence both lands and their products have advanced in value beyond the amount of improved acres and of stock and crops. Nothing so clearly demonstrates the value of railroads to the farming community as these statistics. No investments could have been more advantageous to it, although it may never pay a direct dividend.

That the value of farms and their products is generally much influenced by the currency is conceded, but the returns of banks in the census report show conclusively that it had no agency in giving value to lands or crops. The circulation in 1850 was $155,012,881, and in 1860, $207,102,477—an increase of but 33⅗ per cent.

FARMING IMPLEMENTS AND MACHINERY.

The advanced value of farming implements and machinery is sixty-two per cent. This is gratifying, for it points to an important fact, that agriculture is availing itself of those agents—labor-saving powers—which have so rapidly advanced our manufactures. Mowers, reapers, and threshers have made our country known at every industrial exhibition, and they have gone on so many farms, that in the absence of a large part of agricultural labor, estimated at from twenty to twenty-two per cent., the usual harvests have been gathered and threshed, not only without loss to the crops, but at a less cost.

THE INFLUENCE OF MANUFACTURES UPON AGRICULTURE.

The view that has been taken of the progress of our agricultural industry would be incomplete if the causes influencing it were not briefly considered.

There are but two causes that can legitimately promote agriculture—exportation abroad, and consumption of its products at home. So far as our exports affect the industry of agriculture, it is admitted to be advantageous in removing a surplus which, if it remained at home, would depress the home markets. But when the amounts exported are compared with those produced, they will be found small indeed. This home consumption rests chiefly on the diversity of civilized pursuits, and these pursuits are divided into agricultural, manufacturing, and commercial.

The tables reveal the fact that our agriculture is not only largely increasing its products, but that it is changing many of them. At first, agriculture seems to be the exclusive pursuit of a people, until they have attained to a certain population, when local advantages induce attention to manufactures, and mining, resulting in the building up of towns and cities, having influences and connexions which scatter these pursuits in various other portions of a State. Thus the increase of towns and cities in population indicates the progress of manufactures and mining.

To exhibit the changes which these make on our agricultural products, we need but look at the States of Connecticut, Massachusetts, New York, Ohio, and Pennsylvania. Their products of a perishable nature, such as butter, the produce of market gardens and orchards, and the heavy ones, in proportion to their market value, such as Irish potatos, have largely increased, whilst the staple crops, such as wheat and corn, have either not increased, or have been greatly diminished.

The increase in manufactures in the States named will be seen from their value in the following table:

	1850.	1860.
Connecticut	$45,110,102	$83,000,000
Massachusetts	151,137,145	266,000,000
New York	237,597,249	379,623,560
Ohio	62,647,259	125,000,000
Pennsylvania	155,044,910	285,500,000
Total	651,536,665	1,139,123,560

This is an increase of seventy-five per cent. Perishable and heavy agricultural products in proportion to their value find a near home market, which makes their cultivation profitable, whilst meats and breadstuffs are drawn from the remoter States. Hence the fact that wheat production has decreased in several of these States, and even in Ohio its acme has been reached. These facts show the value of manufactures to the agriculture of the country. To the nearer farmer, for perishable and heavy products, they create a profitable market; and to the remoter, for meats and breadstuffs, which may be transported greater distances. It is in this way that manufactures in Massachusetts and Connecticut and Rhode Island sustain, not only the home farmers, but those, too, living in the western States. No investigation would be more interesting or profitable than to trace out in all their details the commerce which different industrial pursuits create between remote States of the Union, and the mutual benefit which such States are to one another. The limits of this article will permit but a general yet comprehensive glance at the magnitude of our industrial pursuits.

THE AGRICULTURE, MANUFACTURES AND COMMERCE OF THE UNITED STATES.

According to estimates based on the census returns for 1850 and 1860, the number of persons engaged in and directly supported by agricultural pursuits is about seventeen millions. The value of the capital invested in lands and implements is $6,897,900,000, yielding an annual product, in value, about $2,598,393,364. The number of persons engaged in and directly supported by manufactures is about five millions. The manufacturing capital invested in real and personal property is $1,050,000,000; in raw material, $1,012,000,000; and the value of the annual product is $1,900,000,000.

These diversified pursuits create a commerce, chiefly internal, that makes us at the same time the admiration and the envy of the world. This commerce has invested in railroads about $1,166,422,729; in canals and river improvements, $1,377,743,789, and uses a tonnage valued at $221,592,480.

The loftiest figures of rhetoric would fail to impress on our minds such a clear impression of the vastness of American industry as do these statistics. No patriot can contemplate them without being the more impressed with the magnitude of the interests involved in the issue of our present struggle to sustain a Union on which this industry is based, and of that Constitution under which these interests have found protection and support.

THE RELATIVE PROFIT OF AGRICULTURAL AND MANUFACTURING LABOR.

In connexion with the general statistics we have presented, there arises a question of much interest, because it relates to the probable future direction labor will take. It is the relative profit of our agricultural and manufacturing labor. "In England," says Mr. Mansfield in his report on Ohio statistics for 1862, "the value of a day's farm labor is not over a third of a bushel of wheat; but in Ohio it is fully worth a bushel of wheat, and generally more." He fixes such labor at eighty-three cents per day, and of manufacturing labor

in clothing, cotton and woollen goods and boots and shoes at eighty cents per day. But other branches of manufactures and mechanism, requiring greater skill, are better paid, and raises the average much above this.

Deducting the raw material from the value of our manufactures, we have the gross profits, as follows:

Annual value of the product	$1,900,000,000
Value of raw material	1,012,000,000
Profit	888,000,000
The annual value of the product of agriculture is	2,598,395,364

As there are three and two-fifths more persons engaged in agriculture than in manufactures, to make the products relatively equal we must reduce the latter amount three and two-fifths times. This makes the relative product as follows:

Profit of manufactures	$888,000,000
Profit of agriculture	764,233,930

or sixteen per cent. in favor of manufacturing labor. And this, we think, is the cause of that rapid development of manufacturing and mining industry, even in such an agricultural State as Ohio. Mr. Mansfield gives the following table, showing this increase between 1850 and 1860 in that State:

Agricultural implements	382	per cent.
Pig iron	80	"
Engines and machinery	120	"
Printing	480	"
Flour and meal	88½	"
Sawed and plain lumber	47½	"
Distilled and malt liquors	80	"
Leather	32½	"
Boots and shoes	56	"
Coal mined	400	"
Salt made	200	"

Something more than the "gregariousness of mankind" draws our industry to towns rather than to the country. Although Mr. Mansfield places the wages of manufacturing labor below those of agricultural labor, he nevertheless admits that "the profits of manufacturing in Ohio are evidently large." This is evidently true, and the only rational cause for it lies in our estimate of its greater profits.

This inequality in the value of the labor of these industrial occupations ought to exist, because the expense of living in towns is greater than in the country. The farmer should rejoice over every inducement leading to an increase of manufactures and mining, for in them he will find his best and most permanent market.

THE MUTUAL DEPENDENCE OF ALL THE STATES.

The want of a statistical bureau in our general government has caused our internal trade to be overlooked, and hence the people of the various sections of the Union remain ignorant of that mutual dependence on each other which a knowledge of its details would have indelibly fixed on their minds.

The cotton-producing States need the western, to supply them with meats and breadstuffs, hay, apples, potatos, horses, and mules. They cannot do without the eastern, for from them they derive the manufactures they consume: their

bale rope and bagging; their engines, sugar mills, and cotton gins; much of the material for their house-building, and mechanics to erect them; their paper, their books, their teachers, their shipping, their capital; in a word, almost everything. In return the west and east consume the cotton, sugar, and rice crops of the south. The western States need the southern, as consumers of pork, bacon, lard, butter, beef, and hay; as purchasers of their horses and mules, of much of their wheat and corn. They want the eastern States also, because they consume large quantities of these provisions; they are the exporters for the west to foreign nations, and furnish much of the capital that makes the highways over which these exports pass to the ocean. The eastern States need both the southern and western, to buy their manufactures, to supply them with textile materials, to feed them, to return them a profit on all their investments of capital in commercial and travelling highways. The Atlantic States need the Pacific, for their gold and wool; while the Pacific States consume all kinds of their manufactures in return.

The mutual supply of these mutual needs created that commerce which has united all by its vast and still greatly increasing railways and canals, its steamboats and ships, its telegraphs, its expresses, its postal facilities. It is this mutual dependence that has called into existence that industry embodied in the agricultural, manufacturing, mining, and commercial statistics we have given. The political union of all is not less essential to all and every part. The broken-up fragments of such industry cannot be united in harmony by treaties and commercial regulations. Nothing but a united government can preserve this harmony.

PROSPERITY OF THE SOUTHERN STATES—THE REBELLION.

No one can examine the tables of statistics without making a comparison between the progress of the sections of our country now known as the loyal and disloyal States, that he may see the causes, if any exist, which have led to a rebellion now desolating so many portions of the south, and consigning to unknown and premature graves so many American citizens.

The following table will aid in instituting such comparison. It shows the per cent. increase, from 1850 to 1860, of the principal agricultural productions of both sections:

	Loyal States.	Disloyal States.
Live-stock	348½ per cent.	249½ per cent.
Value of same	209½ "	194 "
Corn	55⅔ "	16⅘ "
Wheat	67 "	91 "
Tobacco	112½ "	118 "
Cotton	....	213 "
Wool	13½ "	17 "
Hay	36 "	48½ "
Value of farms	93 "	136 "
Total increase	935⅔ "	1,083⅘ "

Great as has been the agricultural prosperity of the country during the last decennial period between 1850 and 1860, we see that the south has not only shared in it, but has outstripped the north. Such prosperity fully sustains the declarations of Mr. Stephens, in his reply to Mr. Toombs, when the former was opposing the secession of Georgia from the Union. He said:

"I notice in the comptroller general's report that the taxable property of Georgia is $670,000,000 and upwards, an amount not far from double what it was in 1850. I think I

may venture to say that for the last ten years the material wealth of the people of Georgia has been nearly if not quite doubled. The same may be said of our advance in education, and everything that makes our civilization."

And, speaking more generally for the south, he asks :

"Have we not at the south, as well as at the north, grown great, prosperous, and happy under the operation of the general government? Has any part of the world ever shown such rapid progress in the development of wealth, and all of the material resources of national power and greatness, as the southern States have under the general government, notwithstanding all its defects?"

Agricultural products do not usually admit a high price both of land and labor. In an article on the grasses of the south, published in the Agricultural Report for 1860, the writer, Mr. C. W. Howard, of Kingston, Georgia, says :

"In no part of Christendom, enjoying a good government and settled by an intelligent population, does land sell for so contemptible a price as in the plantation States. In Georgia, for instance, land does not command an average price of five dollars per acre."

The great increase in the value of farming lands which the tables exhibit, against this social obstacle, shows how favorable have been all other agencies acting on the prosperity of the south.

In his oration on the occasion of laying the corner-stone of the Capitol extension Mr. Webster gives a comparative table to exhibit our unexampled progress from 1793, when the corner-stone of the Capitol was laid by Washington, to 1851, when that of its extension was laid. We take a few of the matters from this table, and carry them up to 1861, the year of the rebellion :

	1793.	1851.	1861.
Population of the United States ..	3,929,328	23,267,498	31,448,322
Amount of imports (dollars)......	31,000,000	178,138,318	362,166,254
Amount of exports (dollars)	26,109,000	151,898,720	400,122,296
Amount of tonnage..............	520,764	3,535,454	5,539,812
Number of miles of railroad	....	10,287	31,196
Cost of the same (dollars)	....	306,607,954	1,166,422,729
Lines of telegraph in miles	....	15,000	40,000

Will the world believe it, will history credit the fact, that in the midst of such unexampled and undreamed-of progress these southern States sought to overthrow that government upon which all this prosperity rested? The world would not believe it, history would not credit it, were not the fact attested by nations as well as by individuals, that high prosperity but hastens the downfall of those who put their trust in these things.

The bishop of St. Asaph, quoted by Mr. Webster in the address just referred to, speaking, before the Declaration of Independence, of the future of the colonies, said :

"Can chance and time, the wisdom and the experience of public men, suggest no new remedy *against the evils which vices and ambition are perpetually apt to cause?* May they not hope, without presumption, to preserve a greater zeal for piety and public devotion than we have done? For sure it can hardly happen to them, as it has to us, that when religion is best understood and rendered most pure and reasonable, that then should be the precise time when many cease to believe and practice it, and all in general become most indifferent to it! May they not possibly be more successful than their mother country has been *in preserving that reverence and authority which is due to the laws?*"

The prodigal son demanded his inheritance from a father that loved him, and went afar off to spend it in riotous living. But the hour followed when want threatened starvation, and then "he came to himself," and with self-reproach came also repentance.

AGRICULTURAL TABLES.

Population of loyal States.

States.	1850.	1860.	Per cent. increase.
California	92,597	365,439	310.37
Connecticut	370,792	460,147	42.10
Delaware	91,532	112,216	22.60
Illinois	851,470	1,711,951	101.06
Indiana	988,416	1,350,428	36.63
Iowa	192,214	674,913	256.64
Kansas	....	107,206	....
Kentucky	982,405	1,155,684	17.64
Maine	583,169	628,279	7.74
Massachusetts	994,514	1,231,066	23.79
Maryland	583,034	687,049	17.84
Michigan	397,654	749,113	88.38
Minnesota	6,077	172,123	....
Missouri	682,044	1,182,012	73.30
New Hampshire	317,976	326,073	2.55
New Jersey	489,555	672,035	37.27
New York	3,097,394	3,880,735	25.28
Ohio	1,980,329	2,339,551	18.14
Oregon	13,294	52,465	294.65
Pennsylvania	2,311,786	2,906,115	25.71
Rhode Island	147,545	174,620	18.35
Vermont	314,120	315,098	0.31
Wisconsin	305,391	775,881	12.29
Total	15,793,308	22,030,199	....

Population of disloyal States.

Alabama	771,623	964,201	24.96
Arkansas	209,897	435,450	107.46
Florida	87,445	140,425	60.59
Georgia	906,185	1,057,286	16.67
Louisiana	517,762	708,002	36.74
Mississippi	606,526	791,305	30.47
North Carolina	869,039	992,622	14.20
South Carolina	668,507	703,708	5.27
Tennessee	1,002,717	1,109,801	10.68
Texas	212,592	604,215	184.22
Virginia	1,421,661	1,596,318	12.29
Total	7,273,954	9,103,333	....

Table of statistics of the agricultural productions of the loyal States for 1840, 1850, *and* 1860.

	States.	Number of horses.			Number of asses and mules.			Number of neat cattle.			Number of sheep.		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
1	California	....	21, 719	173, 164	....	1, 666	17, 196	....	262, 659	1, 236, 229	....	17, 574	1, 099, 132
2	Connecticut	34, 601	26, 879	49, 515	....	49	217	238, 650	212, 675	264, 011	400, 462	174, 181	119, 807
3	Delaware	14, 000	13, 852	20, 353	421	791	2, 734	53, 883	53, 211	64, 500	39, 247	27, 503	19, 396
4	Illinois	191, 266	267, 653	689, 324	7, 969	10, 573	48, 581	626, 224	912, 036	1, 724, 040	395, 672	894, 043	809, 052
5	Indiana	238, 036	314, 299	448, 929	3, 000	6, 599	21, 701	619, 980	714, 666	1, 249, 345	675, 982	1, 122, 493	1, 034, 736
6	Iowa	10, 000	38, 536	210, 975	....	754	7, 767	38, 049	136, 621	630, 428	....	149, 960	280, 495
7	Kansas	....	....	27, 006	....	....	2, 664	....	....	122, 797	....	....	16, 847
8	Kentucky	363, 039	315, 682	416, 913	32, 804	65, 609	136, 062	787, 098	752, 512	964, 104	1, 008, 240	1, 102, 091	1, 006, 151
9	Maine	59, 183	41, 721	88, 934	25	55	202	327, 255	343, 339	454, 174	649, 264	451, 577	514, 398
10	Maryland	89, 398	75, 684	102, 640	2, 822	5, 644	10, 709	225, 714	219, 586	262, 796	257, 922	177, 902	156, 900
11	Massachusetts	61, 474	42, 216	104, 531	10	34	110	282, 574	259, 994	328, 243	378, 226	188, 651	123, 445
12	Michigan	30, 130	58, 506	184, 769	14	70	510	185, 190	274, 497	615, 027	99, 618	746, 435	1, 513, 393
13	Minnesota	....	860	25, 185	....	14	874	....	2, 002	148, 826	....	80	15, 596
14	Missouri	176, 032	225, 319	442, 443	20, 000	41, 667	91, 566	433, 875	791, 510	1, 287, 165	348, 018	762, 511	1, 033, 450
15	New Hampshire	43, 892	34, 233	53, 982	....	19	16	275, 562	267, 910	285, 721	617, 390	384, 756	316, 725
16	New Jersey	69, 000	63, 955	108, 226	1, 502	4, 089	12, 384	220, 202	211, 261	280, 458	219, 285	160, 488	147, 321
17	New York	474, 300	447, 014	596, 183	243	963	3, 846	1, 911, 244	1, 877, 639	2, 004, 974	5, 118 777	3, 453, 241	2, 620, 920
18	Ohio	429, 027	463, 397	739, 930	1, 500	3, 423	10, 157	1, 217, 874	1, 358, 947	1, 882, 806	2, 028, 401	3, 942, 929	3, 196, 540
19	Oregon	....	8, 046	53, 290	....	420	8, 292	....	41, 729	212, 698	....	15, 382	86, 724
20	Pennsylvania	364, 100	350, 398	503, 834	1, 029	2, 259	15, 239	1, 172, 665	1, 153, 946	1, 587, 597	1, 767, 620	1, 822, 357	1, 684, 765
21	Rhode Island	8, 024	6, 168	14, 312	....	....	59	36, 891	36, 212	45, 249	90, 146	44, 296	38, 079
22	Vermont	62, 402	61, 057	84, 451	....	218	47	384, 341	348, 938	390, 603	1, 681, 819	1, 014, 122	740, 008
23	Wisconsin	....	30, 179	144, 061	....	156	1, 524	30, 269	183, 433	633, 316	3, 462	124, 896	644, 339
	Total	2, 717, 904	2, 907, 373	5, 277, 950	71, 339	145, 072	390, 457	9, 167, 550	10, 415, 325	16, 675, 107	15, 782, 551	16, 777, 468	17, 198, 219

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Number of swine.			Value of live stock.		Value of animals slaughtered.		Cheese.		Butter.	
		1840.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.
									Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	California	....	2, 776	457, 285	$3, 351, 058	$36, 601, 154	$107, 173	$3, 562, 887	150	1, 564, 857	705	3, 338, 590
2	Connecticut	131, 961	76, 472	101, 154	7, 467, 490	11, 311, 079	2, 202, 266	3, 181, 992	5, 363, 277	3, 898, 411	6, 498, 119	7, 620, 912
3	Delaware	74, 228	56, 261	55, 817	1, 849, 281	3, 144, 706	373, 665	573, 075	3, 187	6, 579	1, 055, 308	1, 430, 502
4	Illinois	1, 495, 254	1, 915, 907	2, 534, 102	24, 209, 258	73, 434, 621	4, 972, 286	15, 159, 343	1, 278, 225	1, 595, 358	12, 526, 543	28, 337, 516
5	Indiana	1, 623, 608	2, 263, 776	2, 644, 502	22, 478, 555	50, 116, 954	6, 567, 935	9, 592, 322	624, 564	569, 574	12, 881, 535	17, 934, 767
6	Iowa	104, 899	323, 247	1, 052, 052	3, 689, 275	21, 776, 786	821, 164	4, 403, 463	209, 840	901, 220	2, 171, 188	11, 526, 002
7	Kansas	....	....	144, 809	....	3, 205, 522	....	547, 450	....	28, 053	....	1, 012, 975
8	Kentucky	2, 310, 533	2, 891, 163	2, 564, 850	29, 661, 436	61, 868, 237	6, 462, 598	11, 640, 740	213, 954	190, 400	9, 947, 523	11, 716, 609
9	Maine	117, 386	54, 598	75, 979	9, 705, 726	15, 437, 533	1, 646, 773	2, 780, 179	2, 434, 454	1, 799, 862	9, 243, 811	11, 687, 781
10	Maryland	416, 943	352, 911	402, 869	7, 997, 634	14, 667, 853	1, 954, 800	2, 821, 510	3, 975	8, 342	3, 806, 160	5, 265, 295
11	Massachusetts	143, 221	81, 119	117, 094	9, 647, 710	12, 737, 744	2, 500, 924	2, 915, 045	7, 088, 142	5, 294, 090	8, 071, 370	8, 297, 936
12	Michigan	295, 890	205, 847	431, 980	8, 008, 734	23, 220, 026	1, 328, 327	4, 080, 720	1, 011, 492	2, 009, 064	7, 065, 878	14, 650, 384
13	Minnesota	....	734	120, 970	92, 859	3, 655, 366	2, 840	732, 418	....	198, 904	1, 100	2, 961, 591
14	Missouri	1, 271, 161	1, 702, 625	2, 776, 793	19, 887, 580	53, 693, 973	3, 367, 106	9, 844, 449	203, 572	259, 633	7, 834, 359	12, 704, 837
15	New Hampshire	121, 671	63, 487	69, 358	8, 871, 001	10, 924, 627	1, 522, 873	3, 787, 500	3, 196, 563	2, 232, 092	6, 977, 056	6, 956, 764
16	New Jersey	261, 443	250, 370	307, 605	10, 679, 291	16, 134, 693	2, 638, 552	4, 120, 276	365, 756	182, 172	9, 487, 210	10, 714, 447
17	New York	1, 900, 065	1, 018, 252	1, 060, 968	73, 570, 499	103, 856, 296	13, 573, 883	15, 841, 403	49, 741, 413	48, 548, 288	79, 766, 094	103, 097, 279
18	Ohio	2, 099, 746	1, 964, 770	2, 492, 739	44, 121, 741	80, 433, 780	7, 439, 243	14, 293, 972	20, 819, 542	23, 758, 738	34, 449, 379	50, 495, 745
19	Oregon	....	30, 235	90, 388	1, 876, 189	6, 272, 892	164, 530	640, 196	36, 980	82, 456	211, 464	1, 012, 339
20	Pennsylvania	1, 503, 964	1, 040, 366	1, 231, 502	41, 500, 053	69, 672, 726	8, 219, 848	13, 399, 378	2, 505, 034	2, 508, 556	39, 878, 418	58, 653, 511
21	Rhode Island	30, 659	19, 509	24, 720	1, 532, 637	2, 042, 044	667, 486	713, 725	316, 508	177, 252	995, 670	1, 014, 856
22	Vermont	203, 800	66, 296	67, 959	12, 643, 228	15, 884, 393	1, 861, 336	2, 549, 001	8, 720, 834	8, 077, 689	12, 137, 980	15, 681, 834
23	Wisconsin	51, 383	159, 276	404, 825	4, 898, 385	17, 807, 366	920, 178	3, 368, 710	400, 283	1, 104, 459	3, 633, 750	13, 651, 053
	Total	14, 157, 815	14, 539, 997	19, 180, 379	347, 738, 520	707, 900, 371	69, 312, 946	130, 549, 754	104, 537, 745	104, 996, 049	268, 640, 620	399, 763, 525

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Wool.			Wheat.			Rye.			Indian corn.		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
		Pounds.	*Pounds.*	*Pounds.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1	California	....	5, 620	2, 681, 822	....	17, 228	5, 946, 619	....	....	51, 244	....	12, 236	524, 857
2	Connecticut	889, 870	497, 454	335, 986	87, 009	41, 762	52, 401	737, 424	600, 893	618, 702	1, 500, 441	1, 935, 043	2, 059, 835
3	Delaware	64, 404	57, 768	50, 201	315, 165	482, 511	912, 941	33, 546	8, 066	27, 209	2, 099, 359	3, 145, 542	3, 892, 337
4	Illinois	650, 007	2, 150, 113	2, 477, 563	3, 335, 393	9, 414, 575	24, 159, 500	88, 197	83, 364	981, 322	22, 634, 211	57, 646, 984	115, 296, 778
5	Indiana	1, 237, 919	2, 610, 287	2, 466, 264	4, 049, 375	6, 214, 458	15, 219, 120	129, 621	78, 792	400, 226	28, 155, 887	52, 964, 363	69, 641, 591
6	Iowa	23, 039	373, 898	653, 036	154, 693	1, 530, 581	8, 433, 205	3, 792	19, 916	176, 055	1, 406, 241	8, 656, 799	41, 116, 994
7	Kansas	....	....	22, 593	....	....	168, 527	....	....	3, 928	....	....	5, 678, 834
8	Kentucky	1, 786, 847	2, 297, 433	2, 325, 124	4, 803, 152	2, 142, 822	7, 394, 811	1, 321, 373	415, 073	1, 055, 262	39, 847, 120	58, 672, 591	64, 043, 633
9	Maine	1, 465, 551	1, 364, 034	1, 495, 063	848, 166	296, 259	233, 877	137, 941	102, 916	123, 290	950, 528	1, 750, 056	1, 546, 071
10	Maryland	488, 201	477, 438	491, 511	3, 345, 783	4, 494, 680	6, 103, 480	723, 577	226, 014	518, 901	8, 233, 086	10, 749, 858	13, 444, 922
11	Massachusetts	941, 906	585, 136	377, 267	157, 923	31, 211	119, 783	536, 014	481, 021	388, 085	1, 809, 192	2, 345, 490	2, 157, 063
12	Michigan	153, 375	2, 043, 283	4, 062, 858	2, 157, 108	4, 925, 889	8, 313, 185	34, 236	105, 871	494, 197	2, 277, 039	5, 641, 420	12, 152, 110
13	Minnesota	....	85	22, 740	....	1, 401	2, 195, 812	....	125	124, 259	....	16, 725	2, 987, 570
14	Missouri	562, 265	1, 627, 164	2, 069, 778	1, 037, 386	2, 981, 652	4, 227, 586	68, 608	44, 268	293, 262	17, 332, 524	36, 214, 537	72, 892, 157
15	New Hampshire	1, 260, 517	1, 108, 476	1, 160, 212	422, 124	185, 658	238, 966	308, 148	183, 117	128, 248	1, 162, 572	1, 573, 670	1, 414, 628
16	New Jersey	397, 207	375, 396	349, 250	774, 203	1, 601, 190	1, 763, 128	1, 665, 820	1, 255, 578	1, 439, 497	4, 361, 975	8, 759, 704	9, 723, 336
17	New York	9, 845, 295	10, 071, 301	9, 454, 473	12, 286, 418	13, 121, 498	8, 681, 100	2, 979, 323	4, 148, 182	4, 786, 905	10, 972, 286	17, 858, 400	20, 061, 048
18	Ohio	3, 685, 315	10, 196, 371	10, 648, 161	16, 571, 661	14, 487, 351	14, 532, 570	814, 205	425, 918	656, 146	33, 668, 144	59, 078, 695	70, 637, 140
19	Oregon	....	29, 686	208, 943	....	211, 943	822, 408	....	106	2, 714	....	2, 918	74, 566
20	Pennsylvania	3, 048, 564	4, 481, 570	4, 752, 523	13, 213, 077	15, 367, 691	13, 045, 231	6, 613, 873	4, 805, 160	5, 474, 792	14, 240, 022	19, 835, 214	28, 196, 821
21	Rhode Island	183, 830	129, 692	90, 699	3, 098	49	1, 131	34, 521	26, 409	28, 259	450, 498	539, 201	458, 912
22	Vermont	3, 699, 235	3, 400, 717	2, 975, 544	495, 800	535, 955	431, 127	230, 993	176, 233	130, 976	1, 119, 678	2, 032, 396	1, 463, 020
23	Wisconsin	6, 777	253, 963	1, 011, 915	212, 116	4, 286, 131	15, 812, 625	1, 965	81, 253	888, 534	379, 359	1, 988, 979	7, 565, 290
	Total	30, 390. 124	44, 136, 700	50, 183, 626	64, 269, 650	82, 372, 495	138, 809, 133	16, 463, 177	13, 268, 275	18, 792, 013	192, 600, 162	351, 420, 821	547, 029, 514

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Oats.			Barley.			Buckwheat.			Hay.		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Tons.*	*Tons.*	*Tons.*
1	California	....	....	957, 684	....	9, 712	4, 507, 775	....	....	36, 486	....	2, 038	306, 741
2	Connecticut	1, 453, 262	1, 258, 738	1, 522, 218	33, 759	19, 099	20, 813	303, 043	229, 297	309, 107	426, 704	516, 131	562, 445
3	Delaware	927, 405	604, 518	1, 046, 910	5, 260	56	3, 646	11, 299	8, 615	16, 355	22, 483	30, 159	36, 973
4	Illinois	4, 988, 008	10, 087, 241	15, 336, 072	82, 251	110, 795	1, 175, 651	57, 884	184, 506	345, 069	164, 932	601, 952	1, 834, 265
5	Indiana	5, 981, 605	5, 655, 014	5, 028, 755	28, 015	45, 483	296, 374	49, 019	149, 740	367, 797	178, 029	403, 230	635, 322
6	Iowa	216, 385	1, 524, 345	5, 879, 653	728	25, 093	454, 116	6, 212	52, 516	216, 524	17, 953	89, 055	707, 260
7	Kansas	....	....	80, 744	....	....	4, 128	....	....	36, 799	....	....	50, 812
8	Kentucky	7, 155, 974	8, 201, 311	4, 617, 029	17, 491	95, 343	270, 685	8, 169	16, 097	18, 929	88, 306	113, 747	158, 484
9	Maine	1, 076, 409	2, 181, 037	2, 988, 939	355, 161	151, 731	802, 109	51, 443	104, 523	339, 520	691, 358	755, 889	975, 716
10	Maryland	3, 534, 211	2, 242, 151	3, 959, 298	3, 594	745	17, 350	73, 606	103, 671	212, 338	106, 687	157, 956	191, 944
11	Massachusetts	1, 319, 680	1, 165, 146	1, 180, 075	165, 319	112, 385	134, 891	87, 000	105, 895	123, 202	569, 395	651, 807	665, 331
12	Michigan	2, 114, 051	2, 866, 056	4, 073, 098	127, 802	75, 249	305, 914	113, 592	472, 917	600, 435	130, 805	404, 934	756, 908
13	Minnesota	....	30, 582	2, 202, 050	....	1, 216	125, 130	....	515	27, 677	....	2, 019	274, 952
14	Missouri	2, 234, 947	5, 278, 079	3, 680, 870	9, 801	9, 631	228, 502	15, 318	23, 641	182, 292	49, 083	116, 925	401, 070
15	New Hampshire	1, 296, 114	973, 381	1, 329, 213	121, 899	70, 256	121, 103	105, 103	65, 265	89, 996	496, 107	598, 854	642, 741
16	New Jersey	3, 083, 524	3, 378, 063	4, 539, 132	12, 501	6, 492	24, 915	856, 117	878, 934	877, 386	334, 861	435, 950	508, 729
17	New York	20, 675, 847	26, 552, 814	35, 175, 133	2, 520, 068	3, 585, 059	4, 186, 667	2, 287, 885	3, 183, 955	5, 126, 305	3, 127, 047	3, 728, 797	3, 564, 786
18	Ohio	14, 393, 103	13, 472, 742	15, 479, 133	212, 440	354, 358	1, 601, 082	633, 139	638, 060	2, 327, 005	1, 022, 037	1, 443, 142	1, 602, 513
19	Oregon	....	61, 214	900, 204	....	....	26, 463	....	....	2, 685	....	373	26, 441
20	Pennsylvania	20, 641, 819	21, 538, 156	27, 387, 149	209, 893	165, 584	530, 716	2, 113, 742	2, 193, 692	5, 572, 026	1, 311, 643	1, 842, 970	2, 245, 420
21	Rhode Island	171, 517	215, 232	234, 453	66, 490	18, 875	40, 993	2, 979	1, 245	3, 573	63, 449	74, 418	82, 725
22	Vermont	2, 222, 584	2, 307, 734	3, 511, 605	54, 781	42, 150	75, 282	228, 416	209, 817	215, 821	836, 739	866, 153	919, 066
23	Wisconsin	406, 514	3, 414, 672	11, 059, 270	11, 062	209, 692	678, 992	10, 654	79, 878	67, 622	30, 938	275, 662	853, 799
	Total	93, 892, 961	113, 008, 226	152, 168, 687	4, 038, 315	5, 109, 004	15, 433, 297	7, 014, 620	8, 702, 779	17, 114, 949	9, 668, 556	13, 112, 161	18, 004, 443

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Potatoes.			Value of productions of market gardens.			Peas and Beans.		Hops.		Maple sugar.	
		1840.	1850.	1860.	1840.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.
		Bushels.	*Bushels.*	*Bushels.*				*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	California	....	10, 292	1, 805, 294	....	$75, 275	$1, 074, 143	2, 292	184, 962	....	....	....	....
2	Connecticut	3. 414, 238	2, 689, 805	1, 855, 858	$61, 926	196, 874	337, 025	19, 090	25, 864	554	959	50, 796	44, 259
3	Delaware	200, 712	305, 985	520, 144	4, 035	12, 714	37, 197	4, 120	7, 438	348	414	....	....
4	Illinois	2, 025, 520	2, 672, 294	6, 141, 407	71, 911	127, 494	418, 195	82, 814	112, 624	3, 551	7, 129	248, 904	131 751
5	Indiana	1, 525, 794	2, 285, 048	4, 157, 434	61, 212	72, 864	288, 070	35, 773	77, 701	92, 796	75, 053	2, 921, 192	1, 515, 594
6	Iowa	234, 063	282, 363	2, 751, 553	2, 170	8, 848	141, 549	4, 775	45, 570	8, 242	1, 797	78, 407	248, 951
7	Kansas	....	....	293, 189	....	....	36, 353	....	10, 167	....	130	....	1, 548
8	Kentucky	1, 055, 085	2, 490, 666	2, 814, 090	125, 071	303, 120	458, 246	202, 574	288, 349	4, 309	5, 899	437, 405	380, 941
9	Maine	10, 392, 280	3, 436, 040	6, 376, 052	51, 579	122, 387	194, 006	205, 541	246, 918	40, 120	102, 987	93, 542	306, 742
10	Maryland	1, 036, 433	973, 932	1, 288, 173	133, 197	200, 869	530, 221	12, 816	34, 407	1, 870	2, 943	47, 740	63, 281
11	Massachusetts	5, 385, 652	3, 585, 384	3, 202, 517	283, 904	600, 020	1, 397, 623	43, 709	45, 346	121, 595	111, 301	795, 525	1, 006, 078
12	Michigan	2, 109, 205	2, 361, 074	5, 301, 018	4, 051	14, 738	145, 058	74, 254	182, 195	10, 663	61, 704	2, 439, 794	2, 988, 018
13	Minnesota	....	21, 345	2, 028, 726	....	150	94, 681	10, 002	18, 802	....	149	2, 650	370, 947
14	Missouri	783, 168	1, 274, 511	2, 325, 952	37, 181	99, 454	346, 405	46, 017	107, 999	4, 130	2, 265	178, 910	142, 430
15	New Hampshire	2, 206, 606	4, 304, 919	4, 137, 704	18, 085	56, 810	76, 256	70, 856	79, 445	257, 174	130, 428	1, 298, 863	2, 255, 012
16	New Jersey	2, 072, 069	3, 715, 251	5, 206, 522	249, 613	475, 242	1, 542, 155	14, 174	27, 675	2, 133	3, 722	2, 197	3, 455
17	New York	30, 123, 614	15, 403, 997	26, 454, 912	499, 126	912, 047	3, 381, 596	741, 546	1, 609, 334	2, 536, 299	9, 655, 542	10, 357, 487	10, 816, 458
18	Ohio	5, 805, 021	5, 245, 760	9, 050, 781	97, 606	214, 004	860, 313	60, 168	105, 219	63, 731	22, 344	4, 588, 200	3, 323, 942
19	Oregon	....	91, 326	312, 035	....	90, 241	86, 335	6, 566	34, 616	....	187	....	....
20	Pennsylvania	9, 535, 663	6, 032, 904	11, 790, 658	232, 912	688, 714	1, 384, 970	55, 231	123, 094	22, 088	41, 576	2, 326, 525	2, 768, 965
21	Rhode Island	911, 973	651, 029	543, 855	67, 741	98, 298	146, 661	6, 846	7, 699	277	50	....	....
22	Vermont	8, 869, 751	4, 951, 014	5, 148, 531	16, 276	18, 853	24, 792	104, 649	68, 912	288, 023	631, 641	6, 349, 357	9, 819, 939
23	Wisconsin	419, 608	1, 402, 956	3, 850, 850	3, 106	32, 142	207, 153	20, 657	99, 804	15, 930	135, 587	610, 976	1, 584, 406
	Total	88, 106, 465	64, 187, 895	107, 337, 255	2, 020, 712	4, 421, 158	13, 209, 603	1, 824, 470	3, 544, 140	3, 473, 833	10, 993, 807	32, 828, 770	37, 772, 717

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Value of orchard products.			Wine.			Tobacco.			Value of home-made manufactures		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
					Gallons.	*Gallons.*	*Gallons.*	*Pounds.*	*Pounds.*	*Pounds.*			
1	California	....	$17, 700	$607, 459	....	58, 055	494, 516	....	1, 000	3, 150	....	$7, 000	$265, 674
2	Connecticut	$296, 232	175, 118	508, 848	2, 666	4, 269	46, 783	471, 657	1, 267, 642	6, 000, 133	$226, 162	192, 252	48, 954
3	Delaware	28, 211	46, 574	114, 225	322	145	683	272	....	9, 699	62, 116	38, 121	17, 591
4	Illinois	126, 756	446, 049	1, 145, 936	474	2, 997	47, 093	564, 326	841, 394	7, 014, 230	993, 567	1, 155, 902	933, 815
5	Indiana	110, 055	324, 940	1, 212, 142	10, 265	14, 055	88, 275	1, 820, 306	1, 044, 620	7, 246, 132	1, 289, 802	1, 631, 039	847, 251
6	Iowa	50	8, 434	131, 234	....	420	3, 706	8, 078	6, 041	312, 919	25, 966	221, 292	314, 016
7	Kansas	....	....	724	....	....	241	....	....	16, 978	....	....	15, 371
8	Kentucky	434, 935	106, 230	604, 851	2, 209	8, 093	179, 949	53, 436, 909	55, 501, 196	108, 102, 433	2, 622, 262	2, 459, 128	2, 095, 578
9	Maine	149, 384	342, 865	501, 767	2, 236	724	3, 165	....	....	1, 583	804, 397	513, 599	490, 787
10	Maryland	105, 740	164, 051	252, 196	7, 585	1, 431	3, 222	24, 816, 012	21, 407, 497	38, 410, 865	176, 050	111, 828	67, 003
11	Massachusetts	389, 177	463, 995	925, 519	193	4, 688	20, 915	64, 955	138, 246	3, 233, 198	231, 942	205, 333	245, 886
12	Michigan	16, 075	132, 650	1, 137, 678	....	1, 654	13, 733	1, 602	1, 245	120, 621	113, 955	340, 947	143, 181
13	Minnesota	....	....	298	....	....	394	....	....	38, 510	....	....	8, 057
14	Missouri	90, 878	514, 711	810, 975	22	10, 563	27, 827	9, 067, 913	17, 113, 784	25, 086, 196	1, 149, 544	1, 674, 705	1, 984, 262
15	New Hampshire	239, 979	248, 543	557, 934	94	344	9, 401	115	50	21, 281	538, 303	393, 455	251, 113
16	New Jersey	464, 006	607, 268	429, 402	9, 416	1, 811	21, 083	11, 922	310	149, 485	201, 625	112, 781	27, 588
17	New York	1, 701, 935	1, 761, 950	3, 726, 380	6, 799	9, 172	61, 404	744	83, 189	5, 764, 582	4, 636, 547	1, 280, 333	717, 865
18	Ohio	475, 271	695, 921	1, 858, 673	11, 524	48, 207	562, 640	5, 942, 275	10, 454, 449	25, 528, 972	1, 853, 937	1, 712, 196	600, 081
19	Oregon	....	1, 271	474, 934	....	....	2, 603	....	325	215	....	....	4, 914
20	Pennsylvania	618, 179	723, 389	1, 479, 938	14, 328	25, 590	38, 623	325, 018	912, 651	3, 181, 586	1, 303, 093	749, 132	544, 732
21	Rhode Island	32, 098	63, 994	83, 691	803	1, 013	507	317	....	705	51, 180	26, 495	7, 824
22	Vermont	213, 944	315, 255	198, 427	94	659	2, 923	585	....	12, 153	674, 548	267, 710	63, 295
23	Wisconsin	37	4, 823	76, 006	....	113	9, 511	115	1, 268	87, 595	12, 567	43, 624	128, 423
	Total	5, 492, 942	7, 165, 751	16, 839, 327	69, 030	194, 003	1, 639, 197	96, 523, 119	108, 774, 907	230, 343, 321	16, 967, 563	13, 136, 872	9, 864, 161

Table of statistics of the agricultural productions of the loyal States—Continued.

	States.	Maple molasses.		Sorghum molasses.		Clover seed.		Grass seed.		Cash value of farms.		Cash value of farm implements and machinery.	
		1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.
		Gallons.	*Gallons.*		*Gallons.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*				
1	California				100		4		162	$3, 874, 041	$46, 571, 994	$103, 483	$2, 443, 297
2	Connecticut	665	227		305	13, 841	13, 671	16, 628	13, 024	72, 726, 422	90, 830, 005	1, 892, 541	2, 339, 481
3	Delaware	50			852	2, 525	3, 595	1, 403	1, 165	18, 880, 031	31, 426, 357	510, 279	817, 883
4	Illinois	8, 354	21, 423		797, 096	3, 427	16, 687	14, 380	202, 808	96, 133, 290	432, 531, 072	6, 405, 561	18, 276, 160
5	Indiana	180, 325	203, 028		827, 777	18, 320	45, 321	11, 951	31, 866	136, 385, 173	344, 902, 776	6, 704, 444	10, 420, 826
6	Iowa	3, 162	97, 751		1, 993, 474	342	1, 564	2, 096	69, 432	16, 657, 567	118, 741, 405	1, 172, 869	5, 190, 042
7	Kansas				79, 482		98		2, 633		11, 394, 184		675, 336
8	Kentucky	30, 079	139, 036		365, 861	3, 230	2, 308	21, 481	62, 563	155, 021, 262	291, 496, 955	5, 169, 037	7, 474, 573
9	Maine	3, 167				9, 097	48, 851	9, 214	6, 307	54, 861, 748	78, 690, 725	2, 284, 557	3, 298, 327
10	Massachusetts	1, 430	2, 404		862	1, 002	1, 295	5, 085	4, 852	87, 178, 545	145, 973, 677	2, 463, 443	4, 010, 529
11	Maryland	4, 693				15, 217	39, 811	2, 561	3, 195	109, 076, 347	123, 255, 948	3, 209, 584	3, 894, 998
12	Michigan	19, 823	384, 521		266, 509	16, 989	49, 480	9, 285	6, 555	51, 872, 446	163, 279, 087	2, 891, 371	5, 855, 642
13	Minnesota		21, 829		14, 974		156		2, 314	161, 948	19, 070, 737	15, 981	1, 044, 009
14	Missouri	5, 636	18, 289		776, 101	619	2, 216	4, 346	55, 713	63, 225, 543	230, 632, 126	3, 981, 525	8, 711, 508
15	New Hampshire	9, 811				829	11, 992	8, 071	5, 573	55, 245, 997	69, 689, 761	2, 314, 125	2, 682, 412
16	New Jersey	954	8, 088		360	28, 280	39, 208	63, 051	85, 410	120, 237, 511	180, 250, 338	4, 425, 503	5, 746, 567
17	New York	56, 539	131, 841		265	88, 222	106, 933	96, 493	81, 622	554, 546, 642	803, 343, 593	22, 084, 926	29, 166, 565
18	Ohio	197, 308	392, 932		707, 416	103, 197	216, 545	37, 310	53, 475	358, 758, 603	666, 564, 171	12, 750, 585	16, 790, 226
19	Oregon	24			419	4	307	22	3, 793	2, 849, 170	14, 765, 355	183, 423	949, 103
20	Pennsylvania	50, 652	127, 455		9, 605	125, 030	274, 363	53, 013	57, 204	407, 876, 099	662, 050, 707	14, 722, 541	22, 442, 842
21	Rhode Island	4	5			1, 328	1, 221	3, 708	4, 229	17, 070, 802	19, 385, 573	497, 201	587, 241
22	Vermont	5, 997				760	2, 444	14, 936	11, 420	63, 367, 227	91, 511, 673	2, 739, 282	3, 554, 728
23	Wisconsin	9, 874			19, 253	483	3, 848	5, 003	26, 383	28, 528, 563	131, 117, 082	1, 641, 568	5, 758, 847
	Total	588, 547	1, 550, 829		5, 860, 801	432, 742	881, 918	380, 037	791, 698	2, 474, 534, 977	4, 767, 475, 301	98, 163, 829	162, 131, 142

Table of statistics of the agricultural productions of the disloyal States for 1840, 1850, *and* 1860.

	States.	Number of horses.			No. of asses and mules.		Number of neat cattle.			Number of sheep.		
		1840.	1850.	1860.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
		Horses and mules.										
1	Alabama	143, 147	128, 001	138, 897	59, 895	112, 676	668, 018	728, 015	819, 391	163, 243	371, 880	381, 465
2	Arkansas	51, 472	60, 197	106, 578	11, 559	48, 193	188, 786	292, 710	570, 903	42, 151	91, 256	209, 155
3	Florida	12, 043	10, 848	17, 986	5, 002	12, 054	118, 081	261, 085	464, 063	7, 198	23, 311	31, 633
4	Georgia	157, 540	151, 331	174, 412	57, 379	120, 069	884, 414	1, 097, 528	1, 208, 952	267, 107	560, 435	633, 214
5	Louisiana	99, 888	89, 514	103, 265	44, 849	107, 175	381, 248	575, 342	597, 866	98, 072	110, 333	202, 498
6	Mississippi	109, 227	115, 460	119, 579	54, 547	113, 083	623, 197	733, 970	733, 758	128, 367	304, 929	338, 816
7	North Carolina	166, 608	148, 693	180, 616	25, 259	59, 882	617, 371	693, 510	807, 051	538, 279	595, 249	624, 045
8	South Carolina	129, 921	97, 171	81, 125	37, 483	56, 456	572, 608	777, 686	506, 776	232, 981	285, 551	233, 508
9	Tennessee	341, 409	270, 636	311, 473	75, 303	128, 092	822, 851	750, 762	818, 686	741, 593	811, 591	803, 171
10	Texas	....	76, 760	416, 118	12, 463	76, 082	....	930, 114	4, 365, 042	....	100, 530	1, 104, 544
11	Virginia	326, 438	272, 403	300, 308	21, 483	47, 622	1, 024, 148	1, 076, 269	1, 187, 720	1, 293, 772	1, 310, 004	1, 155, 537
	Total	1, 537, 693	1, 421, 014	1, 980, 357	405, 222	881, 384	5, 900, 722	7, 916, 991	12, 080, 208	3, 512, 763	4, 565, 069	6, 097, 587

	States.	Number of swine.			Value of live stock.		Value of animals slaughtered.		Cheese.		Butter.	
		1840.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.	1850.	1860.
									Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	Alabama	1, 423, 873	1, 904, 540	1, 800, 487	$21, 690, 112	$43, 061, 805	$4, 823, 485	$10, 325, 022	31, 412	9, 607	4, 008, 811	6, 125, 708
2	Arkansas	393, 058	836, 727	1, 174, 298	6, 647, 969	22, 040, 211	1, 163, 313	3, 895, 399	30, 088	16, 952	1, 854, 239	4, 062, 481
3	Florida	92, 680	209, 453	300, 406	2, 880, 058	5, 480, 789	514, 685	1, 201, 441	18, 015	3, 784	371, 488	404, 470
4	Georgia	1, 457, 755	2, 168, 617	2, 411, 466	25, 728, 416	38, 372, 734	6, 339, 762	10, 908, 204	46, 976	15, 587	4, 640, 558	5, 439, 765
5	Louisiana	323, 220	597, 301	693, 610	11, 152, 275	24, 751, 822	1, 458, 990	2, 083, 736	1, 957	5, 494	683, 069	1, 440, 943
6	Mississippi	1, 001, 209	1, 582, 734	1, 537, 272	19, 403, 662	40, 245, 079	3, 636, 582	7, 528, 007	21, 191	3, 419	4, 346, 234	5, 111, 185
7	North Carolina	1, 649, 716	1, 812, 813	2, 090, 190	17, 717, 647	31, 130, 805	5, 767, 866	10, 414, 546	95, 921	51, 119	4, 146, 290	4, 735, 495
8	South Carolina	878, 532	1, 065, 503	965, 779	15, 060, 015	23, 934, 465	3, 502, 637	6, 072, 822	4, 970	1, 543	2, 981, 850	3, 177, 934
9	Tennessee	2, 926, 607	3, 104, 800	2, 452, 525	29, 978, 016	61, 257, 374	6, 401, 765	12, 345, 696	177, 681	126, 794	8, 139, 585	10, 000, 823
10	Texas	....	692, 022	1, 566, 639	10, 412, 927	52, 892, 934	1, 116, 137	5, 218, 987	95, 299	277, 512	2, 344, 900	5, 948, 611
11	Virginia	1, 992, 155	1, 829, 843	1, 787, 640	33, 656, 659	47, 794, 256	7, 502, 986	11, 488, 441	436, 292	280, 792	11, 089, 359	13, 461, 712
	Total	12, 138, 805	15, 804, 353	16, 780, 312	194, 327, 756	390, 962, 274	42, 228, 208	81, 482, 301	959, 802	792, 603	44, 606, 394	59, 909, 127

Table of statistics of the agricultural productions of the disloyal States—Continued.

	States.	Wool.			Grass seed.		Wheat.			Rye.		
		1840.	1850.	1860.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
		Pounds.	*Pounds.*	*Pounds.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1	Alabama	220, 353	657, 118	681, 404	547	653	838, 052	294, 044	1, 222, 487	51, 008	17, 261	73, 942
2	Arkansas	64, 943	182, 595	410, 285	436	3, 110	105, 878	199, 639	955, 298	6, 219	8, 047	77, 869
3	Florida	7, 285	23, 247	58, 594			412	1, 027	2, 808	305	1, 152	21, 314
4	Georgia	371, 303	990, 019	946, 229	428	1, 914	1, 801, 830	1, 088, 534	2, 544, 913	60, 693	53, 750	115, 532
5	Louisiana	49, 283	109, 897	296, 187	97	701		417	29, 283	1, 812	475	12, 789
6	Mississippi	175, 196	559, 619	637, 729	533	1, 175	196, 626	137, 990	579, 452	11, 444	9, 606	41, 260
7	North Carolina	625, 044	970, 738	883, 473	1, 275	3, 008	1, 960, 855	2, 130, 102	4, 743, 706	213, 971	229, 563	436, 856
8	South Carolina	299, 170	487, 233	427, 102	30	38	968, 354	1, 066, 277	1, 285, 631	44, 738	43, 790	89, 091
9	Tennessee	1, 060, 332	1, 364, 378	1, 400, 508	9, 118	41, 532	4, 569, 692	1, 619, 386	5, 409, 863	304, 320	89, 137	265, 344
10	Texas		131, 917	1, 497, 748		2, 976		41, 729	1, 464, 273		3, 108	95, 012
11	Virginia	2, 538, 374	2, 860, 765	2, 509, 443	23, 428	53, 063	10, 109, 716	11, 212, 616	13, 129, 180	1, 482, 799	458, 930	944, 024
	Total	5, 411, 283	8, 337, 526	9, 748, 702	35, 894	108, 170	20, 551, 415	17, 791, 761	31, 366, 894	2, 177, 309	914, 819	2, 173, 033

	States.	Clover seed.		Indian corn.			Oats.			Barley.		
		1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1	Alabama	138	187	20, 947, 004	28, 754, 048	32, 161, 194	1, 406, 353	2, 965, 696	716, 435	7, 692	3, 958	14, 703
2	Arkansas	90	60	4, 846, 632	8, 893, 939	17, 758, 665	189, 553	656, 183	502, 866	760	177	3, 079
3	Florida			898, 974	1, 996, 809	2, 824, 538	13, 229	66, 586	46, 779	30		15
4	Georgia	132	635	20, 905, 122	30, 080, 099	30, 776, 293	1, 610, 030	3, 820, 044	1, 231, 817	12, 979	11, 501	14, 682
5	Louisiana			5, 952, 910	10, 266, 373	16, 205, 856	107, 353	89, 637	65, 845			144
6	Mississippi	84	217	13, 161, 237	22, 446, 552	29, 563, 735	668, 624	1, 503, 288	121, 033	1, 654	228	1, 596
7	North Carolina	576	332	23, 893, 763	27, 941, 051	30, 078, 564	3, 193, 941	4, 052, 078	2, 781, 860	3, 574	2, 735	3, 445
8	South Carolina	376	28	14, 722, 805	16, 271, 454	15, 065, 606	1, 486, 208	2, 322, 155	936, 974	3, 967	4, 583	11, 490
9	Tennessee	5, 096	8, 062	44, 986, 188	52, 276, 223	50, 748, 266	7, 035, 678	7, 703, 086	2, 343, 122	4, 809	2, 737	23, 489
10	Texas	10	449		6, 028, 876	16, 521, 593		199, 017	988, 812		4, 776	38 905
11	Virginia	29, 727	36, 961	34, 577, 591	35, 254, 319	38, 360, 704	13, 451, 062	10, 179, 144	10, 184, 865	87, 430	25, 437	68, 759
	Total	36, 231	46, 931	184, 892, 226	240, 209, 743	280, 665, 014	29, 162, 031	33, 556, 914	19, 920, 408	122, 895	56, 132	180, 297

Table of statistics of the agricultural productions of the disloyal States—Continued.

	States.	Buckwheat. 1840.	Buckwheat. 1850.	Buckwheat. 1860.	Rice. 1840.	Rice. 1850.	Rice. 1860.	Tobacco. 1840.	Tobacco. 1850.	Tobacco. 1860.	Cane sugar. 1840.	Cane sugar. 1850.	Cane sugar. 1860.
		Bushels.	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Alabama	58	348	1, 334	149, 019	2, 312, 252	499, 559	273, 302	164, 990	221, 284	10, 143	87, 000	108, 000
2	Arkansas	88	175	488	5, 454	215	218, 936	148, 439	218, 936	999, 757	1, 542	....	....
3	Florida	....	55	....	481, 420	1, 075, 090	223, 209	75, 274	998, 614	758, 015	275, 317	2, 750, 000	1, 761, 000
4	Georgia	141	250	2, 023	12, 384, 732	38, 950, 691	52, 507, 652	162, 894	423, 924	919, 316	329, 744	846, 000	1, 167, 000
5	Louisiana	....	3	160	3, 604, 534	4, 425, 349	6, 455, 017	119, 824	26, 878	40, 610	119, 947, 720	226, 001, 000	297, 816, 000
6	Mississippi	61	1, 121	1, 740	777, 195	2, 719, 856	657, 293	83, 471	49, 960	127, 736	77	8, 000	244, 000
7	North Carolina	15, 391	16, 704	35, 924	2, 820, 388	5, 465, 868	7, 593, 976	16, 772, 359	11, 984, 786	32, 853, 250	7, 163	....	38, 000
8	South Carolina	72	283	602	60, 590, 861	159, 930, 613	119, 100, 528	51, 519	74, 285	104, 412	30, 000	77, 000	198, 000
9	Tennessee	17, 118	19, 427	14, 421	7, 977	258, 854	30, 516	29, 550, 432	20, 148, 932	38, 931, 277	258, 073	3, 000	....
10	Texas	....	59	1, 612	....	88, 203	25, 670	....	66, 897	98, 016	....	7, 351, 000	590, 000
11	Virginia	243, 822	214, 898	477, 808	2, 956	17, 154	8, 225	75, 347, 106	56, 803, 227	123, 967, 757	1, 541, 833	....	....
	Total	276, 751	253, 323	586, 112	80, 824, 536	215, 244, 145	187, 320, 581	123, 084, 620	90, 961, 429	199, 021, 430	122, 401, 612	237, 123, 000	301, 922, 000

	States.	Cane molasses. 1850.	Cane molasses. 1860.	Sorghum. 1860.	Cotton. 1840.	Cotton. 1850.	Cotton. 1860.	Irish and sweet potatos. 1840.	Irish and sweet potatos. 1850.	Irish and sweet potatos. 1860.	Hay. 1840.	Hay. 1850.	Hay. 1860.
		Gallons.	*Gallons.*	*Gallons.*	*Bales.*	*Bales.*	*Bales.*	*Bushels.*	*Bushels.*	*Bushels.*	*Tons.*	*Tons.*	*Tons.*
1	Alabama	83, 428	81, 694	67, 172	292, 847	564, 429	997, 978	1, 708, 356	5, 721, 205	5, 818, 553	12, 718	32, 685	55, 219
2	Arkansas	18	....	....	15, 072	65, 344	367, 485	293, 608	981, 981	1, 880, 714	586	3, 976	8, 276
3	Florida	352, 893	435, 890	....	30, 276	45, 131	63, 322	264, 617	765, 054	1, 232, 042	1, 197	2, 510	7, 594
4	Georgia	216, 245	546, 770	103, 450	408, 481	499, 091	701, 840	1, 291, 366	7, 213, 807	6, 825, 093	19, 970	23, 449	46, 448
5	Louisiana	10, 931, 177	14, 535, 157	....	38, 139	178, 737	722, 218	834, 341	1, 524, 085	2, 403, 626	24, 651	25, 752	46, 999
6	Mississippi	18, 318	3, 445	8, 207	483, 504	484, 292	1, 195, 699	1, 630, 100	5, 003, 277	4, 750, 295	171	12, 504	32, 885
7	North Carolina	704	12, 494	263, 475	12, 982	50, 545	145, 514	2, 609, 239	5, 716, 027	6, 970, 604	101, 369	145, 653	181, 365
8	South Carolina	15, 904	15, 144	51, 041	154, 276	300, 901	353, 413	2, 698, 313	4, 473, 960	4, 342, 433	24, 618	20, 925	87, 592
9	Tennessee	7, 223	294, 322	485, 828	69, 229	194, 532	227, 450	1, 904, 370	3, 845, 560	3, 789, 203	31, 233	74, 091	146, 027
10	Texas	441, 918	388, 937	115, 051	....	58, 072	405, 100	....	1, 426, 803	2, 021, 943	....	8, 354	11, 349
11	Virginia	40, 322	50	221, 017	8, 737	3, 947	12, 727	2, 944, 660	3, 130, 567	4, 252, 926	364, 708	369, 098	445, 529
	Total	12, 108, 150	16, 313, 903	1, 315, 241	1, 513, 543	2, 445, 021	5, 192, 746	16, 178, 970	39, 802, 326	44, 287, 432	578, 221	718, 997	1, 069, 283

Table of statistics of the agricultural productions of the disloyal States—Continued.

	States.	Value of orchard products.			Value of productions of market gardens.			Wine.			Hops.		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
								Gallons.	*Gallons.*	*Gallons.*	*Pounds.*	*Pounds.*	*Pounds.*
1	Alabama	$55, 240	$15, 408	$213, 323	$31, 978	$84, 821	$135, 181	177	220	19, 130	825	276	1, 069
2	Arkansas	10, 680	40, 141	56, 230	2, 736	17, 150	38, 094	....	35	1, 005	....	157	160
3	Florida	1, 035	1, 280	21, 716	11, 758	8, 721	18, 213	124	10	1, 661	....	14	....
4	Georgia	156, 122	92. 776	176, 048	19, 346	76, 500	201, 916	8, 647	796	27, 646	773	261	199
5	Louisiana	11, 769	22, 359	110, 923	240, 042	148, 329	390, 742	2, 884	15	5, 030	115	125	8
6	Mississippi	14, 458	50, 405	259, 380	42, 806	46, 250	124, 608	12	407	10, 106	154	473	221
7	North Carolina	386, 006	34, 348	643, 688	28, 475	39, 462	73, 663	28, 752	11, 058	54, 064	1, 063	9, 246	1, 767
8	South Carolina	52, 275	35, 108	213, 989	38, 187	47, 286	187, 348	643	5, 880	24, 964	93	26	122
9	Tennessee	367, 105	52, 894	314, 269	19, 812	97, 183	274, 163	653	92	15, 562	850	1, 032	2, 329
10	Texas	....	12, 505	46, 802	....	12, 354	55, 943	....	99	13, 946	....	7	122
11	Virginia	705, 765	177, 137	800, 650	92, 359	183, 047	589, 411	13, 911	5, 408	40, 508	10, 597	11, 506	10, 015
	Total	1, 760, 455	5, 340, 361	2, 857, 018	527, 589	761, 103	2, 091, 282	55, 803	24, 020	211, 622	14, 470	23, 123	16, 018

	States.	Value of home manufactures.			Value of farm implements and machinery.			Cash value of farms.		
		1840.	1850.	1860.	1840.	1850.	1860.	1840.	1850.	1860.
1	Alabama	$1, 656, 119	$1, 934, 120	$1, 920, 175	....	$5, 125, 663	$7, 287, 509	....	$64, 323, 224	$172, 176, 168
2	Arkansas	489, 750	638, 217	928, 481	....	1, 601, 296	4, 024, 114	....	15, 265, 245	91, 673, 403
3	Florida	....	75, 582	62, 243	....	658, 795	888, 930	....	6, 323, 109	16, 371, 684
4	Georgia	1, 467, 630	1, 838, 968	1, 431, 413	....	5, 894, 150	6, 844, 387	....	95, 753, 445	157, 072, 803
5	Louisiana	2, 886, 661	139, 232	503, 124	....	11, 576, 938	20, 391, 883	....	75, 814, 398	215, 565, 421
6	Mississippi	682, 945	1, 164, 020	1, 318, 426	....	5, 762, 927	8, 664, 816	....	54, 738, 634	186, 866, 914
7	North Carolina	1, 413, 242	2, 086, 522	2, 045, 372	....	3, 931, 532	5, 873, 942	....	67, 891, 766	143, 301, 065
8	South Carolina	930, 703	909, 525	815, 117	....	4, 136, 354	6, 151, 657	....	82, 431, 684	139, 652, 508
9	Tennessee	2, 622, 462	3, 137, 790	3, 166, 195	....	5, 360, 210	8, 371, 095	....	97, 851, 212	272, 555, 054
10	Texas	....	266, 984	596, 169	....	2, 151, 704	6, 114, 362	....	16, 550, 008	104, 007, 689
11	Virginia	2, 441, 672	2, 156, 312	1, 575, 585	....	7, 021, 772	9, 381, 008	....	216, 401, 543	371, 696, 211
	Total	14, 591, 124	14, 347, 272	14, 362, 300	....	53, 221, 341	83, 993, 793	....	793, 344, 268	1, 870, 938, 920

Summary of the preceding tables.

Products.	Loyal States.	Disloyal States.	Total.
	1840.	1840.	
Horses .... numbers..	2,717,904	1,537,693	4,255,597
Cattle .... do....	9,167,550	5,900,722	15,068,272
Sheep .... do....	15,782,551	3,512,763	19,295,314
Swine .... do....	14,157,815	12,138,805	26,296,620
Wool .... pounds..	30,390,124	5,411,283	35,801,407
Wheat .... bushels..	64,269,650	20,551,415	84,821,065
Rye .... do....	16,463,177	2,177,309	18,640,486
Indian corn .... do....	192,600,162	184,892,226	377,492,388
Oats .... do....	93,892,961	29,162,031	123,054,992
Barley .... do....	4,038,315	122,895	4,161,210
Buckwheat .... do....	7,014,620	276,751	7,291,371
Potatos .... do....	88,106,465	16,178,970	104,285,435
Hay .... tons..	9,668,556	578,221	10,246,777
Tobacco .... pounds..	96,523,119	123,084,620	219,607,739
Cane sugar .... do....	....	122,401,612	122,401,612
Cotton .... bales, 400 pounds..	....	1,513,543	1,513,543
Rice .... do....	....	80,824,536	80,824,536
Wine .... gallons..	69,030	55,803	124,833
Value of market gardens	$2,020,712	$527,589	$2,548,301
Value of orchard products	5,492,942	1,760,455	7,253,397
Value of home manufactures	16,967,563	14,591,124	31,558,687
	1850.	1850.	
Horses .... numbers..	2,907,373	1,421,014	4,328,387
Mules .... do....	145,072	405,222	550,294
Cattle .... do....	10,415,325	7,916,991	18,332,316
Sheep .... do....	16,777,468	4,565,069	21,342,537
Swine .... do....	14,539,997	15,804,353	30,344,350
Wool .... pounds..	44,136,700	8,337,526	52,474,226
Cheese .... do....	104,537,745	959,802	105,497,547
Butter .... do....	268,640,620	44,606,394	313,247,014
Wheat .... bushels..	82,372,495	17,791,761	100,164,256
Rye .... do....	13,268,275	914,819	14,183,094
Indian corn .... do....	351,420,821	240,209,743	591,630,564
Oats .... do....	113,008,226	33,556,914	146,565,140
Barley .... do....	5,109,004	56,312	5,165,316
Buckwheat .... do....	8,702,779	253,323	8,956,102
Potatos .... do....	64,187,895	39,802,326	103,990,221
Peas and beans .... do....	1,824,470	7,271,700	9,096,170
Hops .... pounds..	3,473,833	23,123	3,496,956
Hay .... tons..	13,112,161	718,997	13,831,158
Tobacco .... pounds..	108,774,907	90,961,428	197,736,335
Cane sugar .... do....	....	237,123,000	237,123,000
Maple sugar .... do....	32,828,770	1,424,666	34,253,436
Cane molasses .... gallons..	....	12,108,150	12,108,150
Maple molasses .... do....	588,547	....	588,547
Rice .... pounds..	....	215,204,145	215,204,145
Cotton .... bales, 400 pounds..	....	2,445,021	2,445,021
Wine .... gallons..	194,003	24,020	218,023
Clover seed .... bushels..	432,742	36,231	468,973

Summary of the preceding tables—Continued.

Products.	Loyal States.	Disloyal States.	Total.
	1850.	1850.	
Grass seed ....bushels..	381,037	35,894	416,931
Value of market gardens..............	$4,421,158	$761,103	$5,182,261
Value of orchard products..............	7,165,751	5,340,361	12,506,112
Value of home manufactures........	13,136,872	14,347,272	27,484,144
Value of live stock..................	347,738,520	194,327,756	542,066,276
Value of slaughtered animals.......	69,312,946	42,228,208	111,541,154
Value of farm implements and machinery, &c..................	98,163,829	53,221,341	151,385,170
Value of farms..................	2,474,534,977	793,344,268	3,267,879,245
	1860.	1860.	
Horses...................numbers..	5,277,950	1,980,357	7,258,307
Mules.......................do....	390,457	881,384	1,271,841
Cattle.......................do....	16,675,107	12,080,208	28,755,315
Sheep.......................do....	17,198,219	6,097,587	23,295,806
Swine.......................do....	19,180,379	16,780,312	35,960,691
Wool....................pounds..	50,183,626	9,748,702	59,932,328
Cheese.......................do....	104,996,049	792,603	105,788,652
Butter.......................do....	399,763,525	59,909,127	459,672,652
Wheat...................bushels..	138,809,133	31,366,894	170,176,027
Rye.......................do....	18,792,013	2,173,033	20,965,046
Indian corn.................do....	547,029,514	280,665,014	827,694,528
Oats.......................do....	152,168,687	19,920,408	172,089,095
Barley.......................do....	15,433,297	180,292	15,613,589
Buckwheat.................do....	17,114,949	536,112	17,651,061
Potatos.......................do....	107,372,255	44,287,432	151,659,687
Peas and beans..............do....	3,544,140	11,555,606	15,099,746
Hops....................pounds..	10,993,807	16,018	11,009,825
Hay.......................tons..	18,004,443	1,069,283	19,073,726
Tobacco.................pounds..	230,343,321	199,021,430	429,364,751
Cane sugar.................do....	....	301,922,000	301,922,000
Maple sugar.................do....	37,772,717	1,090,851	38,863,568
Cane molasses...........gallons..	....	16,313,903	16,313,903
Maple molasses.............do....	1,631,832	312,467	1,944,299
Sorghum molasses..........do....	5,860,801	1,315,241	7,176,042
Rice....................pounds..	....	187,320,581	187,320,581
Cotton..........bales, 400 pounds..	....	5,192,746	5,192,746
Wine...................gallons..	1,639,197	211,622	1,850,819
Clover seed..............bushels..	881,868	46,931	928,799
Grass seed.................do....	791,698	108,170	899,868
Value of market gardens...........	$13,209,603	$2,091,282	$15,300,885
Value of orchard products...........	16,839,327	2,857,015	19,696,342
Value of home manufactures.........	9,864,161	14,362,300	24,226,461
Value of live stock................	707,900,731	390,962,274	1,098,863,005
Value of slaughtered animals........	130,549,754	81,482,301	212,032,055
Value of farm implements and machinery....................	162,131,142	83,993,793	246,124,935
Value of farms....................	4,767,474,851	1,870,938,920	6,638,413,771

THE COLLECTION OF STATISTICS.

In creating the Department of Agriculture, Congress specified as one of its leading objects the collection of agricultural statistics. One of the greatest agriculturists of Scotland, Sir John Sinclair, and one of those who were pre-eminent for their vast influence in the advancement of agriculture, regarded such statistics as of the highest utility, and, under his direction, a great expense was incurred and great labor bestowed in the collection, arrangement, and publication of the agricultural statistics of Scotland. In alluding to these statistics, the Duke of Argyle, President of the Highland Agricultural Society of Scotland, at a recent banquet of that society, said:

"And here I cannot help expressing very great regret—a regret in which I am sure that the scientific and intelligent tenant farmers of Scotland will share—that it has been found necessary to give up the system of agricultural statistics in this country. I do not mean to express a decided opinion whether the Highland Society was or was not the fitting organization for gathering that information; but this I do say, that the years during which that statistical information was collected by your secretary, Mr. Maxwell, and freely given by the tenant farmers, were years of great interest in their result, and that the exertions then made reflected the highest credit upon him and upon the farmers of Scotland who supplied him with the information. I say so, because you probably all know that, in England at least, there is a very great prejudice against statistical information; and I believe that there is a sense of the comparative inutility of collecting it in one part of the country when it is not done over the whole country, and the impossibility which every government has hitherto found in insisting upon that information being collected in England, has been one of the causes which have led this society to drop the collection of these statistics. I do not wonder at it. It was a circumstance of very great discouragement, because the value of statistics depends upon their completeness, and if you have not statistics for the whole island, undoubtedly the utility of the statistics you have gathered is very much impaired. Nevertheless, I cannot help expressing the hope that the time is not very far distant when these prejudices to which I have referred, which do not exist in Scotland, will be overcome in England, and that, under the guardianship of the law, a complete system of agricultural statistics will be organized for the whole kingdom."

The prejudices here referred to exist in this country; and under the plans in operation in several of the States for taking some agricultural statistics, the imperfect returns but strengthen these prejudices. The State of Ohio is an exception, and California exhibits a juster regard for statistical information than any other State.

A portion of the agricultural statistics of the whole country is taken every ten years by the general government; but it has reference less to the improvement of agriculture than to the assistance of commerce. It is simply an inventory of the leading crops and of the chief items of agricultural investment. It does not aim to unfold our vast internal commerce, by showing the cost of market transportation and in what sections the crops are consumed. The relation of the different parts of agriculture to each other, to manufactures and commerce, is but imperfectly and very generally exhibited. A political consequence of this was the attempted usurpation of cotton. At what expense to the farmer these crops are produced; at what cost to the soil; what are the errors of our agriculture, its difficulties, its hardships, its wrongs—all such matters are neither directly nor indirectly a purpose or an accomplishment of our decennial statistics.

With means totally inadequate for the collection of statistics by which any of these important purposes might be accomplished, the Commissioner of Agriculture, nevertheless, sought to obtain those within his power, and for useful objects. During last winter he issued circulars to every county in the loyal States, making inquiries relative to the prices of agricultural products in them and the average yield per acre of the leading crops. He issued others, during the summer and fall months, to make known the monthly condition of the crops, their amounts, &c. The medium, for communicating the knowledge

obtained through the latter to the public, was monthly reports, and the following tables will show the statistics obtained in answer to the first circular.

Could the several States and the general government be induced to adopt a uniform and thorough system of taking agricultural statistics but once in ten years—the States every fifth year of this period and the general government every tenth year—the basis thus furnished would be sufficient for this Department, through its regular correspondents, to derive correct information of all matters embodied in this system for the remainder of the years of the decade.

From these general observations concerning the necessity of a thorough system for collecting agricultural statistics, I proceed to the consideration of matters more directly connected with the following tables.

They are designed to show the *amount* of our principal crops; *their yield per acre; the acreage sown or planted; the average prices in each State;* and the *total value* of these crops in each of the loyal States, Kentucky and Oregon excepted, from which no sufficient returns had been received.

For many purposes, it is important to estimate the value of our principal crops, but heretofore no statistics have been collected upon which to base this value. The census returns give the amount only of the crops, and when an estimate of their value is made, the prices of a seaport, usually of New York, have been selected, and by these the value declared. In this way values have been exhibited far above the real value, having no other existence than in this false mode of estimating them.

The census has never returned the yield per acre, nor the number of acres under cultivation. Whether the comparative number of acres was increasing and the yield per acre decreasing, or the contrary, thus showing whether our agricultural production, represented by immense crops, was at the expense of the soil, or whether an improved system of farming was gradually restoring the exhausted soils of past years, were questions of the highest magnitude, but of which no one could speak with any certainty.

To supply this defect of the census returns was one of the purposes of the formation of these tables. It is not claimed for them that they are perfect. On the contrary, to have completely failed in their construction would have been pardonable on account of difficulties on every hand. To have so completely succeeded as to have escaped errors, was not possible.

The plan adopted for the construction of the tables was this: The yield per acre and the prices in the various counties were obtained through circulars sent into every county. These were matters familiar to all farmers; but as the correspondents were among the best farmers, their returns of the yield per acre represent more, perhaps, those of good farming than of good and bad together. The *amount* of the crops could not be ascertained through these correspondents, because no State, with the exception of Ohio, does this with reliable accuracy; and they, therefore, had no basis on which to make correct estimates. Hence, the amount of the crops for 1862 had to be estimated by the Department, and herein lay the chief difficulty in the construction of the tables. The census returns for 1860 were adopted as a basis; but as the crop of 1859, on which they were taken, was an indifferent one, and that of 1862 the best ever grown, the yield per acre of these crops was very different. To estimate the acreage of a crop by dividing a heavy yield per acre into a light crop, would, obviously, give very erroneous results of the number of acres in cultivation. The crop of 1859 had, therefore, to be brought up to that of 1862. Various means were adopted for this purpose—some general, some affecting certain sections of the country, others more local, and in all cases applied as a personal knowledge and a very general acquaintance of the condition of our agriculture dictated. The result, it is believed, is an approximation to correctness, more accurate than State statistics would have accomplished, if taken by all of the States in the usual way. As no circulars were sent to California on account of its re-

moteness, the estimates of its productions are based on its State statistics of the crops for 1861, and their prices in San Francisco; and as Ohio has a much more perfect system of taking its agricultural statistics, its returns have been chiefly relied upon, though not entirely.

When the amount of the crops had been determined, the calculations of the number of acres of each crop, and the total values of them, were simply arithmetical.

As the census of 1860 did not give any returns of root crops, except potatos, there was no basis to estimate the amounts of these for 1862. But their yield per acre and prices in the various States are not uninteresting, and, therefore, they are given in the tables.

Having stated the manner in which the tables were prepared, it is necessary to refer to an instance or two of seeming contradictions, that their explanation may serve to remove any want of reliance which such contradictions might leave on the mind of the reader.

Contrast the difference of prices between the States of Rhode Island and New Jersey. What the first is to the Boston market in locality, the other is to the New York market. Yet there is a much greater difference in their market prices than exists in these cities. The cause of this will be found in the difference of their industry. Rhode Island is chiefly a manufacturing State, and New Jersey an agricultural one; the one receives and the other supplies, and hence the difference of prices should represent the cost of transportation between them.

Again, there is a striking difference between the price of corn in Ohio and Indiana, which are neighboring States, with nearly equal market facilities in many respects. But large quantities of corn in Ohio are consumed in distilleries, and much shipped eastward. Indiana, although much smaller than her neighbors in square miles, is the largest hog-producing State in the Union. Its corn is fed chiefly to this stock, and hence its market price represents the value of corn fed to hogs, while in Ohio it exhibits its value when hauled to the nearest railroad depot.

These instances, one of a whole State and the other of a single product, are selected to apprise the reader of the extent of local peculiarities in determining many matters connected with these tables. A great utility of statistics is their embodiment of many facts which too few are acquainted with, and still fewer are disposed to search out. Hence it is that statistical knowledge is not generally appreciated, as is seen in the fact that our general government has no statistical bureau. And hence, too, the fact that so little is known of our vast internal trade, which has created the great tonnage of our commerce, and given to the Union its unexampled prosperity. And to the ignorance of this trade, as much as to any other cause, may be ascribed the attempt to destroy this Union.

The following tables show the amount of the principal crops for 1862, the yield per acre, the acreage sown or planted, the average prices in each State, and the total value of these crops in the States named.

CALIFORNIA.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn……bushels..	478,169	28	17,339	$1 10	$525,985
Wheat ………….do….	8,805,411	24¼	361,351	1 03	9,069,573
Rye…………….do….	15,505	20	1,415	1 87	*28,994
Oats …………….do….	1,057,592	28¾	36,607	1 00	1,057,592
Barley ………….do….	5,293,442	23¾	223,217	1 20	6,342,130
Buckwheat ……..do….	14,850	20	745	1 14	16,929
Broom corn……pounds..	………	………	1,722	………	………
Tobacco ………..do….	34,850	230	148	………	………
Flax………………….	………	………	2	………	………
Sorghum ……..gallons..	………	………	110	………	………
Hay…………….tons..	304,791	$1\frac{22}{100}$	250,464	12 00	3,657,492
Potatos ………bushels..	1,298,474	62½	20,771	62	805,054
Turnips …………do….	………	………	………	………	………
Ruta-bagas ……..do….	………	………	………	………	………
Mangolds ……….do….	………	………	………	………	………
Carrots …………do….	………	………	………	………	………
Onions …………do….	152,717	169	901	3 00	458,151
Beans …………..do….	104,524	28	3,624	2 55	266,536
Peas ……………do….	7,196	17	427	2 00	14,392
Sweet potatoes …..do….	93,640	142	659¾	2 50	234,100
Wine …………gallons..	343,477	………	………	………	………
Total…………….	………	………	919,502	………	$22,476,928

CONNECTICUT.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn……bushels..	2,059,835	32	64,370	$0 84	$1,730,261
Wheat ………….do….	59,901	17	3,524	1 44	86,257
Rye…………….do….	618,762	14	44,193	86	532,084
Oats …………….do….	1,603,936	33	48,604	48	769,889
Barley ………….do….	20,813	25	833	85	17,691
Buckwheat ……..do….	334,032	16	20,877	70	233,822
Tobacco……….pounds..	7,500,166	1,300	5,769	14	·1,050,023
Hay…………….tons..	562,445	{ 2,100 lbs. }	534,323	12 00	6,749,340
Potatos ………bushels..	1,833,148	108	16,947	45	824,917
Turnips …………do….	………	282	………	17	………
Ruta-bagas ……..do….	………	426	………	19	………
Mangolds ……….do….	………	675	………	17	………
Carrots …………do….	………	456	………	30	………
Onions …………do….	………	324	………	58	………
Beans …………..do….	………	23	………	2 10	………
Peas ……………do….	………	37	………	1 00	………
Total…………….	………	………	739,440	………	$11,995,284

DELAWARE.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	3,892,337	20	194,617	$0 52	$2,024,015
Wheat ....do....	1,217,254	15	81,150	1 12	1,363,324
Rye...............do....	34,011	18	2,001	60	20,407
Oats ....do....	1,308,637	25	52,342	35	458,023
Barley ....do....	4,254	25	170	70	2,978
Buckwheat ....do....	18,399	30	613	50	9,200
Tobacco.........pounds..	12,123	300	41	12	1,455
Hay ....tons..	40,054	3,500 lbs.	22,888	11 60	44,494
Potatos.........bushels..	377,931	112	3,374	50	188,966
Turnips ....do....	....	300	....	22	....
Ruta-bagas ....do....	....	400	....	25	....
Mangolds..........do....	....	500	....	15	....
Carrots ....do....	....	200	....	25	....
Onions ....do....	....	100	....	1 00	....
Sweet potatos ......do....	154,064	137	1,125	50	27,032
Total..............	....	....	358,321	....	$4,139,894

ILLINOIS.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	138,356,135	40	3,458,903	$0 23	$32,821,911
Wheat ....do....	32,213,500	14	2,300,964	76	24,482,260
Rye...............do....	981,322	20	49,066	43	421,968
Oats ....do....	17,892,200	20	894,610	24	4,294,128
Barley ....do....	1,175,651	36	32,657	60	705,390
Buckwheat ....do....	431,336	23	18,754	43	185,474
Broom corn......pounds..	....	767	....	04	....
Tobacco ....do....	9,452,307	1,101	8,585	14	1,323,323
Flax ....do....	....	200 lint.	....	08	....
Sorghum ....gallons..	1,594,192	143	11,148	44	601,444
Hay ....tons..	2,292,831	3,400 lbs.	1,348,724	8 00	18,342,648
Potatos ....bushels..	6,444,404	100	64,444	40	2,577,762
Turnips ....do....	....	178	....	.19	....
Ruta-bagas ....do....	....	279	....	19	....
Mangolds..........do....	....	290	....	25	....
Carrots ....do....	....	375	....	24	....
Onions ....do....	....	159	....	63	....
Beans ....do....	....	24	....	1 26	....
Peas ....do....	....	38	....	88	....
Sweet potatos ......do....	341,443	104	3,283	63	215,109
Wine ....gallons..	47,093	100	471	1 00	47,093
Total..............	....	....	8,191,609	....	$86,018,510

INDIANA.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	92,855,454	42	2,210,847	$0 29	$26,928,032
Wheat...............do....	20,292,160	16	1,268,260	88	17,857,101
Rye.................do....	444,695	20	22,235	53	235,688
Oats ....do....	5,028,755	15	335,250	27	1,357,764
Barley..............do....	345,767	29	11,923	81	280,071
Buckwheat ....do....	367,797	25	14,712	50	183,899
Broom corn.......pounds..	....	844	....	04	....
Tobacco ....do....	9,057,665	1,109	8,167	12	1,086,920
Sorghum ....gallons..	1,241,665	155	8,011	48	595,999
Hay ....tons..	847,096	3,479 lbs.	486,945	7 00	5,929,672
Potatos ....bushels..	4,357,271	112	38,904	40	1,742,908
Turnips ....do....	....	172	....	20	....
Ruta-bagas ....do....	....	261	....	25	....
Mangolds ....do....	....	275	....	25	....
Carrots ....do....	....	200	....	33	....
Onions ....do....	....	207	....	75	....
Beans ....do....	....	33	....	1 34	....
Peas ....do....	....	44	....	96	....
Sweet potatos ......do....	284,304	114	2,406	78	221,757
Wine ....gallons..	88,275	130	679	1 00	88,275
Total..............	....	....	4,408,339	....	$56,508,136

IOWA.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	49,340,393	38	1,298,431	$0 79	$9,374,675
Wheat ....do....	10,541,506	14	752,965	69	7,273,639
Rye.................do....	111,266	23	4,837	40	44,506
Oats ....do....	7,055,583	39	180,912	22	1,552,228
Barley ....do....	544,939	29	18,870	54	295,347
Buckwheat ....do....	276,524	29	9,535	37	102,314
Broom corn.......pounds..	....	750	....	04	....
Tobacco ....do....	375,502	944	398	12	45,060
Sorghum ....gallons..	3,996,948	148	27,006	40	1,598,779
Hay ....tons..	848,712	4,000 lbs.	424,356	8 00	6,789,696
Potatos ....bushels..	3,600,686	144	25,000	32	1,052,220
Turnips ....do....	....	193	....	14	....
Ruta-bagas ....do....	....	252	....	15	....
Mangolds ....do....	....	350	....	25	....
Carrots ....do....	....	397	....	21	....
Onions ....do....	....	186	....	55	....
Beans ....do....	....	25	....	1 01	....
Peas ....do....	....	28	....	78	....
Sweet potatos ......do....	50,138	131	383	94	47,130
Wine ....gallons..	3,706	216	17	....	5,633
Total..............	....	....	2,742,710	....	$28,078,913

KANSAS.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	6,814,601	40	170,365	$0 32	$2,180,672
Wheat ....do....	202,232	21	9,630	74	149,652
Rye...............do....	4,713	28	169	53	2,498
Oats ....do....	96,892	33	2,936	31	30,037
Barley............do....	4,953	37	134	65	3,219
Buckwheat ....do....	44,158	30	1,472	51	22,521
Broom corn......pounds..	....	750	....	04	....
Tobacco ....do....	21,223	1,025	21	20	4,245
Hemp ....do....	....	1,250	....	05	....
Sorghum ....gallons..	158,964	149	1,067	51	81,071
Hay ....tons..	63,515	3,400 lbs.	34,420	6 00	381,090
Potatos ....bushels..	354,960	108	3,287	49	173,931
Turnips ....do....	....	268	....	16	....
Ruta-bagas ....do....	....	282	....	15	....
Mangolds..........do....	....	160	....	20	....
Carrots ....do....	....	260	....	15	....
Onions ....do....	....	186	....	1 12	....
Beans ....do....	....	33	....	1 15	....
Peas ....do....	....	31	....	83	....
Sweet potatos.....do....	11,536	156	74	81	9,344
Total...............	....	....	223,575	....	$3,038,280

MAINE.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	1,855,285	34	54,567	$0 94	$1,743,968
Wheat.............do....	350,815	16	21,926	1 55	543,763
Rye ....do....	184,389	18	10,244	98	180,701
Oats ....do....	3,738,423	36	103,845	42	1,570,138
Barley ....do....	1,002,636	29	34,574	76	762,003
Buckwheat ....do....	452,693	28	16,168	65	294,250
Hay ....tons..	1,170,859	2,222 lbs.	1,053,879	10 00	11,708,590
Potatos ....bushels..	7,437,053	153	48,608	35	2,602,969
Turnips ....do....	....	565	....	21	....
Ruta-bagas ....do....	....	553	....	26	....
Mangolds..........do....	....	628	....	30	....
Carrots ....do....	....	498	....	30	....
Onions ....do....	....	155	....	1 00	....
Beans ....do....	....	18	....	2 18	....
Peas ....do....	....	26	....	1 20	....
Total...............	....	....	1,343,811	....	$19,406,382

MARYLAND.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	14,444,922	28	515,890	$0 62	$8,955,852
Wheat ....do....	6,553,480	14	468,106	1 39	2,554,857
Rye ....do....	608,901	16	30,055	80	487,121
Oats ....do....	4,524,912	26	174,035	40	1,809,965
Barley............do....	21,887	32	684	87	18,942
Buckwheat ....do....	242,672	29	8,368	63	152,883
Broom corn......pounds..	....	700	....	....	....
Tobacco ....do....	40,601,179	933	42,444	11	4,466,130
Hay ....tons..	195,244	{ 3,000 lbs. }	129,830	14 00	2,733,416
Potatos ....bushels..	1,517,314	99	15,326	63	955,908
Turnips ....do....	....	219	....	25	....
Ruta-bagas ....do....	....	220	....	19	....
Onions ....do....	....	126	....	56	....
Beans ....do....	....	24	....	1 41	....
Peas ....do....	....	15	....	1 75	....
Sweet potatos ......do....	23,744	108	220	62	14,721
Wine ....gallons..	3,222	90	36	1 50	4,833
Total...............	....	....	1,384,994	....	22,154,628

MICHIGAN.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	15,190,137	41	370,491	$0 42	$6,379,858
Wheat ....do....	14,963,735	18	831,319	1 00	14,963,735
Rye...............do....	494,197	18	27,455	54	266,866
Oats ....do....	5,430,797	26	208,877	31	1,683,547
Barley ....do....	407,885	28	14,567	75	305,913
Buckwheat ....do....	900,652	23	39,150	43	387,280
Broom corn......pounds..	....	570	....	11	....
Tobacco...........do....	160,825	1,000	161	13	20,907
Flax ....do....	....	{ 255 lint. }	....	14	....
Sorghum ....gallons..	533,018	183	2,913	57	303,820
Hay...............tons..	1,135,362	{ 3,000 lbs. }	756,908	8 00	9,082,896
Potatos ....bushels..	5,264,733	134	39,289	31	1,632,067
Turnips ....do....	....	292	....	18	....
Ruta-bagas ....do....	....	395	....	19	....
Mangolds..........do....	....	462	....	23	....
Carrots ....do....	....	383	....	24	....
Onions ....do....	....	315	....	63	....
Beans ....do....	....	26	....	1 45	....
Peas ....do....	....	25	....	84	....
Sweet potatos ......do....	36,285	107	339	1 00	36,285
Total...............	....	....	2,291,469	....	35,063,174

MINNESOTA.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	3,983,426	45	88,521	$0 38	$1,513,901
Wheat ....do....	2,927,749	20	146,387	56	1,639,539
Rye ....do....	155,323	24	6,472	28	43,490
Oats ....do....	2,934,067	43	68,234	31	909,561
Barley ....do....	156,412	34	4,600	49	76,642
Buckwheat ....do....	34,596	26	1,342	42	14,530
Broom corn......pounds..	....	725	....	05	....
Tobacco ....do....	48,137	1,140	42	11	7,702
Hemp...............do....	....	1,140	....	05	....
Flax ....do....	....	750 lint.	....	09	....
Sorghum ....gallons..	29,948	125	248	62	18,568
Hay................tons..	366,603	4,000 lbs.	183,301	6 00	2,199,618
Potatos ....bushels..	2,703,923	175	15,451	25	675,981
Turnips ....do....	....	400	....	12	....
Ruta-bagas ....do....	....	400	....	13	....
Mangolds...........do....	....	478	....	17	....
Carrots ....do....	....	565	....	20	....
Onions ....do....	....	340	....	49	....
Beans..............do....	....	28	....	1 15	....
Peas ....do....	....	31	....	87	....
Sweet potatos ......do....	976	150	6	1 25	1,220
Total	....	....	514,604	....	7,100,752

MASSACHUSETTS.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	2,465,215	37	66,627	$0 85	$2,095,463
Wheat ....do....	129,765	17	7,633	1 61	208,922
Rye...............do....	388,085	15	25,872	93	360,919
Oats ....do....	1,475,094	35	42,146	50	737,547
Barley ....do....	168,613	26	6,485	87	146,693
Buckwheat ....do....	123,302	21	5,872	72	88,777
Broom corn......pounds..	....	675	....	07	....
Tobacco...........do....	4,041,497	1,144	3,533	14	565,809
Hay................tons..	908,289	2,300 lbs.	789,817	13 00	11,807,757
Potatos ....bushels..	3,201,901	118	27,135	47	1,504,893
Turnips ....do....	....	267	....	21	....
Ruta-bagas ....do....	....	490	....	24	....
Mangolds...........do....	....	748	....	22	....
Carrots ....do....	....	867	....	25	....
Onions ....do....	....	320	....	75	....
Beans..............do....	....	19	....	2 34	....
Peas ....do....	....	20	....	1 55	....
Total	....	....	975,120	....	17,516,780

MISSOURI.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crop.
Indian corn......bushels..	82, 483, 232	38	2, 170, 611	$0 26	$21, 445, 640
Wheat ....do....	5, 636, 781	17	331, 575	77	4, 340, 321
Rye...............do....	351, 914	17	20, 701	45	158, 361
Oats ....do....	4, 601, 087	28	164, 325	27	1, 242, 293
Barley............do....	274, 502	27	10, 167	78	214, 111
Buckwheat ....do....	218, 750	25	8, 750	48	105, 000
Tobacco ....pounds..	28, 609, 948	1, 000	28, 610	12	3, 433, 196
Hemp ....do....	....	916	....	03½	....
Sorghum ....gallons..	1, 552, 202	146	10, 631	43	667, 447
Hay ....tons..	467, 915	3, 000 lbs.	311, 943	8 00	3, 743, 320
Potatos ....bushels..	2, 322, 657	89	26, 097	41	962, 289
Turnips ....do....	....	172	....	15	....
Onions ....do....	....	125	....	70	....
Beans ....do....	....	25	....	1 34	....
Sweet potatoes .....do....	335, 102	106	3, 161	74	247, 975
Wine ....gallons..	27, 827	230	121	1 55	43, 131
Total...............	....	....	3, 086, 692	....	33, 598, 084

NEW HAMPSHIRE.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crop.
Indian corn......bushels..	1, 668, 285	38	43, 902	$0 91	$1, 518, 139
Wheat ....do....	318, 954	15	21, 264	1 53	488, 000
Rye...............do....	162, 033	18	9, 002	91	147, 450
Oats ....do....	1, 495, 365	34	43, 981	34	508, 424
Barley ....do....	141, 287	26	5, 434	79	111, 617
Buckwheat ....do....	98, 995	20	4, 950	69	68, 307
Hay ....tons..	771, 289	2, 300 lbs.	670, 686	12 00	9, 255, 468
Potatos ....bushels..	4, 137, 704	109	37, 961	36	1, 489, 573
Turnips ....do....	....	300	....	22	....
Ruta-bagas ....do....	....	606	....	25	....
Mangolds ....do....	....	475	....	25	....
Carrots ....do....	....	477	....	25	....
Onions ....do....	....	250	....	94	....
Beans ....do....	....	15	....	2 02	....
Peas ....do....	....	19	....	1 25	....
Total...............	....	....	837, 180	....	13, 586, 978

NEW JERSEY.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn.......bushels..	10,023,336	37	270,901	$0 68	$6,815,978
Wheat ....do....	1,808,128	19	95,165	1 30	2,350,566
Rye...............do....	1,499,497	18	83,305	78	1,169,604
Oats ....do....	5,446,958	33	165,059	46	2,405,601
Barley ....do....	33,220	25	1,329	75	24,915
Buckwheat ....do....	1,052,863	23	45,777	71	747,533
Hay ....tons..	529,729	2,500 lbs.	423,783	12 00	6,356,748
Potatos ....bushels..	4,693,151	100	46,931	55	2,581,223
Turnips ....do....	....	192	....	23	....
Ruta-bagas ....do....	....	308	....	30	....
Mangolds...........do....	....	375	....	30	....
Carrots ....do....	....	325	....	33	....
Onions ....do....	....	156	....	68	....
Beans ....do....	....	21	....	2 35	....
Peas ....do....	....	15	....	1 50	....
Sweet potatoes ......do....	1,634,832	95	17,209	75	1,226,126
Total...............	....	....	1,149,459	....	23,678,294

NEW YORK.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn.......bushels..	24,073,257	35	687,807	$0 66	$15,888,350
Wheat ....do....	13,021,650	18	723,425	1 25	16,277,062
Rye...............do....	5,385,268	19	283,435	76	4,092,804
Oats ....do....	43,963,916	35	1,256,255	46	20,225,701
Barley ....do....	4,882,778	29	168,372	1 06	5,175,745
Buckwheat ....do....	5,976,305	22	271,305	54	3,227,204
Broom corn.......pounds..	....	800	....	05½	....
Tobacco ....do....	7,205,727	1,200	6,005	10	720,573
Flax ....do....	....	210	....	14	....
Hay ....tons..	4,455,982	2,800 lbs.	3,182,844	10 00	44,559,820
Potatos ....bushels..	33,059,235	125	264,474	38	12,562,509
Turnips ....do....	....	290	....	23	....
Ruta-bagas ....do....	....	430	....	23	....
Mangolds...........do....	....	500	....	22	....
Carrots ....do....	....	507	....	25	....
Onions ....do....	....	375	....	74	....
Beans ....do....	....	24	....	1 65	....
Peas ....do....	....	24	....	94	....
Wine ....gallons..	61,404	220	279	1 50	92,106
Total...............	....	....	6,844,201	....	119,594,670

OHIO.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	71,792,523	33	2,175,531	$0 44	$31,588,710
Wheat ....do....	30,796,032	16	1,924,752	96	29,564,190
Rye ....do....	1,079,040	16	67,440	60	647,424
Oats ....do....	10,930,935	15	728,729	33	3,607,208
Barley............do....	1,512,525	25	60,501	79	1,194,894
Buckwheat ....do....	1,181,947	23	51,389	53	626,432
Broom corn......pounds..	....	900	....	05$\frac{1}{2}$	....
Tobacco ....do....	25,528,972	940	27,158	11	2,808,187
Flax ....do....	2,389,877	45 lint.	53,108	15	358,481
Sorghum ....gallons..	6,484,800	130	49,883	55	3,566,649
Hay ....tons..	2,073,398	3,000 lbs.	1,461,018	7 00	14,513,786
Potatos ....bushels..	5,128,756	80	64,109	51	2,615,665
Turnips ....do....	....	204	....	26	....
Ruta-bagas ....do....	....	487	....	27	....
Mangolds ....do....	....	612	....	25	....
Carrots ....do....	....	405	....	25	....
Onions ....do....	....	280	....	65	....
Beans ....do....	....	26	....	1 27	....
Peas ....do....	....	30	....	1 27	....
Sweet potatos ......do....	297,908	95	3,137	96	283,012
Wine ....gallons..	562,640	200	2,813	1 37	770,716
Total...............	....	....	6,669,568	....	92,145,345

RHODE ISLAND.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	458,912	37	12,403	$0 84	$385,486
Wheat ....do....	1,413	20	71	1 50	2,119
Rye. ....do....	33,911	21	1,520	86	29,163
Oats ....do....	253,990	45	5,644	48	121,915
Barley ....do....	51,241	30	1,708	95	47,679
Buckwheat ....do....	3,871	17	228	90	3,484
Hay ....tons..	82,725	2,375 lbs.	61,242	16 00	1,323,600
Potatos ....bushels..	543,855	124	4,386	56	304,559
Turnips ....do....	....	266	....	17	....
Ruta-bagas ....do....	....	425	....	20	....
Mangolds ....do....	....	325	....	22	....
Carrots ....do....	....	315	....	18	....
Onions ....do....	....	350	....	59	....
Beans ....do....	....	15	....	2 00	....
Peas ....do....	....	20	....	1 00	....
Total...............	....	....	87,202	....	2,218,005

PENNSYLVANIA.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crop.
Indian corn.......bushels..	30,721,821	36	853,384	$0 56	$17,204,220
Wheat ....do....	15,654,255	18	869,681	1 22	19,098,191
Rye ....do....	6,843,427	18	380,190	72	4,927,267
Oats ....do....	34,233,936	37	925,241	37	12,666,556
Barley ....do....	636,859	29	21,999	85	541,330
Buckwheat ....do....	6,686,431	24	278,601	60	4,011,859
Broom corn.......pounds..	....	800	....	06	....
Tobacco............do....	3,976,982	1,116	3,563	14	556,777
Flax.................	....	160 lint.	....	15	....
Sorghum ....gallons..	19,210	158	122	60	11,526
Hay ....tons..	2,245,420	3,200 lbs.	1,403,388	10 00	22,454,200
Potatos ....bushels..	14,609,335	114	128,152	50	7,304,667
Turnips ....do....	....	180	....	30	....
Ruta-bagas ....do....	....	459	....	21	....
Mangolds ....do....	....	450	....	34	....
Carrots ....do....	....	400	....	26	....
Onions ....do....	....	179	....	69	....
Beans...............do....	....	23	....	1 40	....
Peas ....do....	....	20	....	1 31	....
Sweet potatos ....do....	128,987	122	1,057	1 06	137,726
Wine ....gallons..	48,279	220	219	1 40	67,590
Total...............	....	....	4,865,597	....	88,981,909

VERMONT.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crop.
Indian corn.......bushels..	1,585,020	35	45,286	$0 87	$1,378,967
Wheat ....do....	502,981	16	31,436	1 35	679,024
Rye ....do....	130,976	15	8,732	86	112,640
Oats ....do....	4,389,506	38	115,513	38	1,668,012
Barley ....do....	94,102	24	3,921	78	73,400
Buckwheat ....do....	233,906	27	8,663	47	109,936
Hay ....tons..	985,654	2,200 lbs.	896,049	8 00	7,885,232
Potatos ....bushels..	5,148,531	135	38,137	25	1,287,132
Turnips ....do....	....	381	....	15	....
Ruta-bagas ....do....	....	464	....	17	....
Carrots ....do....	....	539	....	21	....
Onions ....do....	....	266	....	92	....
Beans ....do....	....	22	....	1 64	....
Peas ....do....	....	23	....	86	....
Total...............	....	....	1,147,737	....	13,194,343

WISCONSIN.

Names of products.	Total bush., lbs., or gallons.	Average yield per acre.	Number of acres to each crop.	Value per bushel, pound, &c.	Total value of crops.
Indian corn......bushels..	10,087,053	40	252,176	$0 40	$4,034,821
Wheat..............do....	20,765,781	17	1,221,517	78	16,197,309
Rye................do....	1,066,241	18	59,236	49	522,458
Oats ....do....	13,271,124	42	315,979	34	4,512,182
Barley ....do....	905,323	33	27,434	71	642,779
Buckwheat ....do....	84,527	26	3,251	44	37,192
Broom corn......pounds..	....	516	....	04	....
Tobacco............do....	109,493	1,200	91	12	13,139
Flax ....do....	....	500 lint.	....	20	....
Sorghum ....gallons..	38,516	125	308	59	22,725
Hay ....tons..	1,067,248	2,950 lbs.	723,558	8 00	8,537,984
Potatos ....bushels..	4,840,631	151	32,057	32	1,549,002
Turnips ....do....	....	291	....	17	....
Ruta-bagas ....do....	....	354	....	20	....
Mangolds...........do....	....	533	....	25	....
Carrots............do....	....	575	....	22	....
Onions ....do....	....	292	....	61	....
Beans ....do....	....	27	....	1 16	....
Peas ....do....	....	30	....	1 00	....
Sweet potatos .....do....	2,345	60	39	1 00	2,345
Wine ....gallons..	9,511	216	44	2 00	19,022
Total..............	....	....	2,635,690	....	36,090,958

Summary showing the value of certain crops of each State, the acreage of those crops in each State, the total value of these crops, and their total acreage.

States.	Value of crops.	Acreage of each State.	Crops.	Total acreage.*
California	$22,476,928	919,502	Indian corn	15,022,741
Connecticut	11,995,234	739,440	Wheat	11,477,181
Delaware	4,139,894	358,321	Rye	1,137,575
Illinois	86,018,510	8,191,609	Oats	5,869,145
Indiana	56,508,136	4,408,339	Barley	649,579
Iowa	28,078,913	2,742,710	Buckwheat	810,522
Kansas	3,038,280	223,575	Tobacco	134,736
Maine	19,406,382	1,343,811	Sorghum	111,964
Maryland	22,154,628	1,384,994	Hay	15,150,366
Massachusetts	17,516,780	975,120	Potatos	960,840
Michigan	35,063,174	2,291,469	Sweet potatos	33,098
Minnesota	7,100,752	514,604	Wine	4,679
Missouri	33,598,084	3,086,692		
New Hampshire	13,586,978	837,180		
New York	119,594,670	6,844,201		
New Jersey	23,678,294	1,149,459		
Ohio	92,145,344	6,669,654		
Pennsylvania	88,981,909	4,865,597		
Rhode Island	2,218,005	87,202		
Vermont	13,194,543	1,147,737		
Wisconsin	36,090,958	2,635,690		
Total	736,586,326	51,393,300		51,363,416

* The acreage of flax is not included in the total acreage.

THE AGRICULTURE OF CALIFORNIA.

SYNOPSIS.

1. *Climate of California, and its effects on agricultural production.*—The principal cereal crops stated.—The animal farm stock of the State compared with that of other States.—The influence of this climate on grape-growing.

2. *The relation of this agriculture to the development of the mining wealth of the western slope of the Rocky mountains.*—The extent of the mining districts; that of the farming lands.—The danger of exhausting the soil.—The evil tendencies of large estates, and of uncertain land titles.—The ownership of the lands, and their several characters.—The true agricultural policy of California is in an adherence to the principles of the homestead law.

I have had placed before me the annual report of the Surveyor General of the State of California for the year 1862, containing the agricultural statistics of that State; and Mr. Hittel's "Resources of California," a recent work of much merit, on its agriculture, mining, geography, climate, commerce, &c. These present the agriculture of this State comprehensively and clearly. For two reasons it is well worthy a careful study, on account of the peculiar climate

of California, and the relation of this agriculture to the development of the mineral wealth of the Pacific and Rocky mountain regions. I will consider these in the order stated.

1. THE CLIMATE OF CALIFORNIA AND ITS EFFECTS ON AGRICULTURE.

The climate of the Atlantic States, as far west as the middle of Texas, Kansas, and Nebraska Territory, is wet in summer; that of California, and the Territories of New Mexico, Colorado, Utah and Nevada, is dry, being almost rainless during the summer months. A glance at the cause of this great difference will not be without profit or interest, and its knowledge is essential to an understanding of the climate of California.

On each side of the equator, when the sun is vertically above it, and reaching to about the fifteenth degree of latitude on each side of it, and moving with the sun as it travels north and south of the equator, is a belt of dry surface winds encircling the earth, and blowing with a uniform and gentle force into the equator. The wind of the north belt blows from the northeast; that of the south belt from the southeast. As these surface winds approach each other they rise, being expanded by the intense heat of the vertical sun, and become upper currents. The surface or lower currents are called the trade-winds; the upper, the counter trade. Mr. Maury and Mr. Butler maintain that the south belt of trade-wind, when it rises, becomes the northern counter trade or upper current, and the north belt of trade-wind becomes the southern upper counter trade. These currents pass through each other in strata, which may be represented by passing the fingers of the hands between each other. But the generally received opinion is, that these surface currents strike against each other as they ascend, and turn each other back over the hemispheres from which they came. I regard the first opinion as more philosophical, because currents of air more readily stratify than repel each other; and because the southern hemisphere of the earth is chiefly water, the immense evaporations of which are more needed to water the land hemisphere of the north than to be discharged on the ocean, where they are not needed. "Nothing has been formed without a purpose."

Between the points from which these opposing surface belts of wind begin to rise there is a belt of rains also encircling the earth, and about five hundred miles wide. It is called the rainy belt, and from it pour down those torrents of rain which fall on Central America.

As these dry surface trade-winds pass over the land and the ocean they absorb immense quantities of moisture, and their capacity to hold it is increased by the great heat imparted to them from the rays of the vertical sun. After they have risen, and become the upper or counter trade, the north one passes, at first in a northern direction. But on account of the diurnal rotation of the earth it is gradually turned to the east, forming the southwest wind, so general during summer in the Atlantic States. As it passes northwards into colder atmosphere it loses its heat; the moisture, in consequence, condenses, and at about fifteen degrees north of the equator portions of the wind and moisture descend to the earth. Other portions having received the latent heat liberated from the moisture that has descended as rain, continue northwards even to the north pole. The portions of the earth receiving these rains are called the extra tropical rainy regions.

This central rainy belt and these two belts of dry trade-winds follow the sun in its passage north of the equator to the tropic of Cancer, nearly to the twenty-fourth degree of latitude. As the northern edge of the dry trade-winds reach fifteen degrees north of the latitude of the sun when the latter is at the tropic of Cancer, this northern edge reaches to about the thirty-ninth degree of latitude, being within three degrees of the northern boundary line

of California. But before the sun reaches the tropic of Cancer, and after it begins to recede from it, northern California receives the rains that fall beyond the dry trade-winds. Thus this part of the State receives more rain than the southern portion, which is longer covered by the trade-winds.

If this belt of dry trade-winds encircled the earth, the Atlantic States, as far north as Washington city, would have the dry climate of California. Why have they not? The question is not easily answered. The theory advocated by Mr. Butler furnishes, perhaps, the most satisfactory answer. He maintains that the central rainy belt is carried over the Atlantic States in this manner: As the trade-winds rise at the equator they are passing in a westwardly direction, and being below the tops of the mountains in Central America, they are checked in their course by them and are accumulated. The general course of the mountains being northwest, the accumulated atmosphere is carried in the same direction, and it takes with it the central rainy belt. The diurnal motion of the earth acts on this accumulated current, and turns it eastward, carrying the central rainy belt as far north as the northern lakes. It is the rains of this belt and the condensed vapors of the currents of air from this deflected atmosphere that falls in summer over the Atlantic States.

This very brief notice of the machinery adopted by nature for the distribution of rain over the earth may serve to show the reason why the Atlantic and Pacific States have different summer climates. Whilst the general characteristic of the California climate is dryness in summer, it has marked subdivisions of climate, and to these, and their causes, attention is now asked.

Running along the eastern boundary of the State are the high Nevada range of mountains. Between these and the coast is the Diabolo range, and near the coast are short, irregular lines of mountains. These give marked characteristics of climate to the country lying between them. The high mountains covered with snow produce cool night air, which renders the climate unfit for the production of corn. The middle of the Sacramento valley becomes very hot during the day. The cold ocean currents which flow southward along the coast create heavy fogs, which moisten the air, and mitigate the heat during the day and the coldness of the nights. But the nearest or coast mountains arrest these fogs. The melting snows of the mountains create numerous streams, forming tributaries to the Sacramento and Joaquin rivers, enabling the miner to wash out the gold and the farmer to irrigate his crops. South of Tulare Lake, lying from the southern line about one-fourth the distance across the State, north and south, these streams are not found; and receiving but little rain, we have here the climate of California in its most intense dryness, rendering the lands better adapted for sheep-growing than any other agricultural interest, and for vineyards along the moist low grounds bordering on the small streams.

Having considered the general and local climates of this State, I turn now to notice its principal crops.

WHEAT.

This is its chief cereal crop. In 1861 the acres sown were 361,351, yielding 8,805,411 bushels, being 24¼ bushels to the acre. The winter and spring varieties of this grain are unknown in California, but are seemingly blended together, the time of sowing being intermediate—in the months of December and January, after the rains which set in during November have moistened the earth. Its quality is superior, on account of its greater amount of gluten, its whiteness, and thinness of skin. The best counties for its production are those in the immediate vicinity of the bay of San Francisco, being Alameda, Contra Costa, Napa, San Joaquin, Santa Clara, Solano, and Yolo. Their united product in 1861 was 6,008,336 bushels. The fogs on the coast are unfavorable to wheat production.

BARLEY.

A sandy soil and a dry climate are known to be favorable to barley growing. Hence it is, relatively, a much greater crop in California than in the Atlantic States. Its amount in 1861 was 5,293,442 bushels; the number of acres 223,217, yielding $23\frac{3}{4}$ bushels per acre; but forty bushels have been raised, and a premium crop was sixty-seven bushels. The counties producing most are Alameda, Butte, Mendocino, Monterey, Sacramento, San Joaquin, Santa Clara, Sutter, Yolo, and Yuba. In 1861 they yielded 3,763,779 bushels. This grain is sown during the entire winter, commencing with the rains in November, and may be continued until the close of March. Owing to the dryness of the climate the grain rapidly dries after maturity, and in harvesting it shatters out some. This sprouts and takes root in the rainy season, and yields a crop well worth harvesting, which is called a "volunteer crop."

OATS.

The common oats do not succeed well on account of the dryness of the climate; but there are wild oats belonging to California, which, although an annual plant, is perpetuated from year to year by self-seeding. It mixes itself the first year with the "volunteer crop" of barley, and in the second year appropriates most of the soil to itself. This crop is mown for hay, and constitutes the hay crop of California, except in some counties in the northern part of the State, which produce timothy. It forms a nutritious hay, but the grain is too small to be profitable as a cereal production. In 1861 the oats raised amounted to 1,057,592 bushels, the yield per acre being $28\frac{3}{4}$ bushels generally, but there were counties which raised forty bushels per acre.

CORN.

This is a very limited crop in this State. As already remarked, the nights are too cool for its successful cultivation in the valley of the Sacramento and Joaquin rivers. The returns from California for 1861 show that there were 17,339 acres in corn, yielding 478,169 bushels, being 28 bushels to the acre. The counties of Los Angeles, Mendocino, Sonoma, and Yuba produced 268,963 bushels. The first three are coast counties, where the fog preserves a more equal temperature, and the first two are in the extreme south, where the summers are warm.

ROOT CROPS.

The reputation that this State has for growing root crops to the highest perfection is known everywhere. Its pure air, freedom from intense heat and excessive wet, makes it favorable for all these crops. It is not a little surprising, therefore, to find that in 1861 the number of acres in potatos was 20,771, producing but 1,298,474 bushels, which is $62\frac{1}{2}$ bushels to the acre. Onions yielded 169 bushels per acre, sweet potatos 142 bushels. The coast counties of Marin, Monterey, and Sonoma are most favorable for potato production, showing that a moist atmosphere is essential in California for potato-growing, or a moist locality of the soil.

HAY.

As already stated, the hay crop is taken from the wild oats. The amount of hay in 1861 was 304,791 tons, from 250,464 acres, being $1\frac{22}{100}$ tons per acre. The dryness of the climate is unfavorable to the grasses, timothy growing in the extreme north alone, which the dry trade-wind belt covers for a short time only. This unsuitableness for grass production is a feature in

California agriculture that should receive much attention, because, when once exhausted, how is the fertility of the soil to be restored? Herein lies a danger to California that must *now* be avoided.

HARVESTING CROPS.

In this State farm labor-saving implements and machinery are used very extensively. As soon as the grain is matured it dries up so rapidly that if not harvested immediately it shatters out. The high price of labor, too, induces this use of machinery. But when the grain is secured in the shock the pressure ends, for both grain and hay may remain out in the fields the entire summer without injury. They are not injured because there are no rains; even the wild oats when uncut, remain an excellent food for stock during the summer.

ANIMALS.

The animal farm stock of California in 1861 was as follows:

Horses	164,293
Mules	23.855
Cattle	900,920
Sheep	1,154,543
Goats	11,591
Hogs	322,905
Total	2,578,107

This is a large animal product, when considered with reference to the population of this State. But in California there is a large amount of grazing land unfit for the plough, and this, too, is an element to be considered. "Of the 160,000 square miles in the area of California," says Mr. Hittel, "about 60,000 may be tillable; and of the 40,000,000 tillable acres, at least 30,000,000 are so dry that they cannot, because of the want of moisture and the impossibility of irrigation, be made to produce any crop save small grain; and of the remaining 10,000,000 acres, three-fourths will not yield fruits, maize, potatos, pumpkins, or garden vegetables, without irrigation." A country like this should become a great stock-growing State, especially when the climate is of such character as to dispense, in a great degree, with winter feeding. "Ohio," says the same writer, "cuts five times as much hay, in proportion to the number of her horses and cattle, as does California, of which at least three-fourths is consumed at home." The wheat straw, uninjured by rust or rain, must be a good foddering substance, and this, with what hay can be made of the wild oats, must furnish an amount of food sufficient to sustain a large stock during the short feeding season.

The State of Indiana, one of the best in animal production, had in 1860 5,306.664 head. Its population is about three times as great as that of California, but its farm stock only twice as much. But its cereal production is, proportionably, much greater. The California bushels of wheat, barley, oats, rye, corn, and potatos are 16,948,593, whilst those of Indiana are 94.459,195, a third of which would be 31,486,398. That is, Indiana has nearly double as much cereal food, in proportion to population, as California. It is, therefore, in grain production that this State may prove deficient for the demands that may in the future be made upon it.

FRUITS.

In determining the capacity of California to produce human food—for it will be seen presently that this article has that chiefly in view—fruit production must not be overlooked.

The annual statistics of the number of trees and vines and their product are

carefully taken by the State; and, in so doing, it presents an example worthy of all imitation by every other State and by the general government. The list shows the remarkable adaptation of California to all fruits, both of the warm and temperate regions. Among the fruit trees are the apricot, quince, nectarine, cherry, plum, pear, peach, apple, cherimoya, persimmon, prune, pineapple, pomegranate, olive, orange, lemon, citron, aloe, and gooseberry; and among the vines are the grape, strawberry, and raspberry. There are also the walnut, almond, and pecan. The value of the fruit, the tons of grapes, and the gallons of wine and brandy are also taken in its annual statistics.

From the returns of the counties in the Surveyor General's report, the soil and climates adapted to fruit-growing appear to be much more extensive than are suited to profitable grain production. The middle of the Sacramento valley is perhaps too hot and dry for fruits, but the slopes at the base of its mountains are most excellent. Smaller valleys, with their higher elevations, are no less suitable. The great length of the State north and south, in connexion with its mountain elevations, adapts the State to the growth of the large and varied list of fruits just stated.

It is too early in the history of California to determine the localities adapted to each fruit and their extent. I shall, therefore, not dwell upon them, but content myself with an examination of its capability in the production of the grape.

THE GRAPE.

The number of grape vines in California in 1861 was 10,592,688, of which Los Angeles county had 2,570,000 and Sonoma 1,701,661. All European varieties of the grape grow well in this State, as also those of the Atlantic States. This fact is significant of the remarkable adaptation of its climate and soil to the culture of the grape, and indicates that California will become the greatest wine country of the world. Mr. Hittel, in summing up its superiority, says:

"California vineyards produce ordinarily twice as much as the vineyards of any other grape district, if general report be true. The grape crop never fails, as it does in every other country. Vineyards in every other country require more labor, for here the vine is not trained to a stake, but stands alone."

To set forth more particularly the peculiar advantages of California, as well as to place before the vine-grower in the Atlantic States the causes of them, it is proper to dwell more at length on the soil and climate of California as they influence the success of grape-growing.

1. THE SOIL.

"The vine," says Mr. Hittel, "likes a sandy or gravelly (not very moist) soil, and never thrives in wet, loamy, or stiff clay soil." Rich land does not seem to be well adapted to the vine there. He remarks:

"The soil of the vineyards at Los Angeles and Anaheim is a deep, light, warm sand. To the inexperienced eye it looks as though it were too poor to produce any valuable vegetable growth. In Sonoma and Napa valleys the vineyards are planted in a red, gravelly clay near the foot of the mountains, or in a light, sandy loam in the centre of the valley. Of late the vine-growers of these valleys have done without irrigation. In Santa Clara valley most of the vines have been placed in a rich, black loam, but their vineyards are unhealthy. The Sacramento vines are planted in sandy loam; those of the Sierra Nevada in sandy loam or in gravelly clay."

These soils are very general in California, and Mr. Hittel, speaking of the extent of the grape region there, says:

"The grape region extends from the southern boundary a distance of five hundred and ninety-five miles north, with an average breadth from east to west of about one hundred miles."

2. CLIMATE.

The influence of climate, in its altitudes, heats, and rains, on grape-growing has not received that systematic consideration which is due to its importance. The western States have at times in the summer months a moist, sweltry atmosphere, during which the grape rot is most fatal. The general elevation of these States is from five hundred to seven hundred feet above the sea level. Whether a greater elevation, from one thousand to two thousand feet above it, would not be free from the rot is a question not yet determined. In a dry climate, like that of California, the altitude is immaterial, for the dryness is sufficient in the lowest localities to shield the grape from rot. If these localities have a rich and moist soil, then, as we have seen, the vines are unhealthy in California. Mr. Hittel, alluding to the *oidium*, says:

"This disease, which has done such great damage in France, appeared in 1859, but has done no injury as yet save in a few small young vineyards. I have heard of it only in Santa Clara, Sonoma, and Alameda counties, where the vines are planted in a wet, black loam or stiff clay."

This disease seems to be one resembling a combination of our blight and mildew.

As California appears to be free from the rot, a comparison of its climate as to dryness with the Atlantic climate, both in the older States and in Europe, may not be useless, either in showing the superiority of California, or in directing attention in these older States to the true cause of the rot. The following tables are taken from Mr. Blodget partly, and also from the meteorology of the Smithsonian publications:

AMERICAN PACIFIC CLIMATES.

Inches of rain.

	Spring.	Summer.	Autumn.	Winter.	Total.
California.					
Sacramento	3.3	0.1	3.2	6.9	13.5
San Francisco	4.6	0.7	3.7	8.8	17.8
Los Angeles	2.5	0.1	1.6	5.5	9.7
New Mexico.					
El Paso	0.6	6.6	4.9	0.3	12.4
Albuquerque	0.6	5.6	1.2	1.0	8.4

AMERICAN ATLANTIC CLIMATES.

Inches of rain.

	Spring.	Summer.	Autumn.	Winter.	Total.
Cincinnati	11.9	14.2	10.0	11.3	47.5
Cleveland	9.1	11.6	9.8	6.9	27.4
Ann Arbor	7.3	11.2	7.0	3.1	28.6
Pittsburg	9.5	12.3	7.6	7.4	36.8
St. Louis	12.7	14.6	8.7	7.0	42.5
Nashville	14.1	14.0	12.3	12.4	52.8

EUROPEAN CLIMATES.

Inches of rain.

	Spring.	Summer.	Autumn.	Winter.	Total.
Turin, Piedmont	8.2	9.0	11.5	7.8	36.5
Valley of the Rhone	10.2	9.5	10.4	4.3	34.4
Vevay, Switzerland	7.9	10.8	11.1	3.9	33.8
Manheim, Rhine	6.3	8.0	7.4	5.3	27.0
Bordeaux, West France	7.3	7.4	10.3	9.0	34.0
Dijon, East France	7.1	7.5	9.3	7.3	31.2
Chalons, Northeast France	5.4	6.2	6.1	5.6	23.3
Lisbon, Portugal*	....	....	....	....	....
Funchal, Madeira*	....	....	....	....	....
St. Michael's, Azores	6.6	3.6	9.5	11.7	31.4

* Dry summers.

These tables exhibit an average fall of rain during summer in California of 0.3 of an inch, and in the Atlantic States of 13 inches nearly, and in European vine-growing countries of 7.7 inches. The climate of California would be more favorable if it had more rain in summer, but in moist situations, or where irrigation may be employed, it presents all that invites to grape production.

This brief glance at the agriculture of California reveals the fact that it has a great capacity for stock and fruit production, but a limited one as to the cereals.

2. The next proposed inquiry is a consideration of the relation between this agriculture and the mining interests of the Pacific and interior districts.

THE EXTENT OF THESE MINING DISTRICTS.

Mr. Chase, in his report as Secretary of the Treasury for 1862, thus speaks of the extent of these mining districts:

"But the American republic possesses immense resources which have not yet been called into contribution. The gold-bearing region of the United States stretches through near eighteen degrees of latitude, from British Columbia on the north to Mexico on the south, and through more than twenty degrees of longitude, from the eastern declination of the Rocky mountains to the Pacific ocean. It includes two States, California and Oregon; four entire Territories, Utah, Nevada, New Mexico, and Dakota. It forms an area of more than a million of square miles, the whole of which, with comparatively unimportant exceptions, is the property of the nation. It is rich not only in gold, but in silver, copper, iron, lead, and many other valuable minerals. Its product of gold and silver during the current year will not probably fall very much, if at all, short of $100,000,000, and it must long continue gradually, yet rapidly, to increase."

The business of mining is rapidly developing itself in the Territories, and it will not be long before Colorado, Utah, and Nevada will be united by continuous settlements. Essential, however, to a rapid and permanent development of this immense mineral wealth are abundant and cheap agricultural products. Where are these to be obtained?

EXTENT OF FARMING LANDS.

This inquiry leads to an examination of the extent of farming lands in the region described by Mr. Chase. The unexplored parts of much of it prevent a definite answer, but the general character of the Rocky mountains points to the fact that between the small amount of level country, its elevation, and the arid nature of the climate, adequate farming lands cannot be found to sustain those engaged in mining. Its valleys are few, narrow, but fertile, demanding

irrigation. Gentlemen who have had some residence in Utah are of the opinion that when there is a general development of the mineral wealth of the Rocky mountains, there must be a dependence on the agriculture of the Mississippi valley. This may be so as to the eastern slope of the Rocky mountains, and for the same reason there will exist a like dependence by the western slope on the agriculture of California. It is not probable that Oregon and Washington will do more than sustain their own development of mineral industry and that of Dakota.

EVILS TO BE AVOIDED.

Assuming that this will be the relation of California agriculture to the mining wealth of the western slope of the Rocky mountains, let us see whether it is sufficient to the demands that may arise upon it from this relation.

The work of Mr. Hittel discloses two evils that must greatly weaken the agricultural production of this State. These are the exhaustion of the soil, and the want of a proper distribution of the ownership of the arable lands.

THE EXHAUSTION OF THE SOIL.

There are several causes producing it. Mr. Hittel says:

"The farmers generally are anxious to make as much money as possible, without regard to the future welfare of the land. Some of them are not permanent residents of the State, and intend to leave it so soon as they can get a certain number of dollars together; others are farming land the title of which is in dispute, and, as they feel uncertain about its ownership, they are indifferent as to its exhaustion. Many of them come from the western States, where the land had not, previous to their migration, become poor; and as rotation of crops had never been a necessity within their experience, they have never adopted it."

It would be difficult to embrace in so brief space more serious causes than those enumerated, for they would jeopardize the fertility of the richest soil under the most favored conditions. But although there are many small valleys in California which are very fertile, yet there is much land that is thin. Add to this that there is no rotation of crops, and no grasses by which the lands can be improved when at rest, and the danger becomes more imminent. Mr. Hittel says:

"Rotation of crops, as the phrase is understood in the Atlantic States and Europe, receives very little attention from the farmers of California, *and, indeed, is impossible on the greater part of the land, because its dryness will not permit the growth of roots or common grasses.*"

And then add to this also the fact that a large proportion of the soil is sand or gravel, whose fertility cannot be restored; that much of its present fertility is due to the manure left on it by the herds of cattle when under Mexican dominion, which is now being rapidly exhausted; and who is so blind as not to foresee that about the time when the mining interests will begin to call loudly on the agriculture of California, it will be too weak from exhaustion to respond to the call?

Again. In the Atlantic States alluvial lands are always enriched by overflowing, and they constitute the finest and most inexhaustible of our corn grounds. But in California the reverse is true. Speaking of the Sacramento valley, Mr. Hittel remarks:

"A large part of the valley, especially of that near the rivers, is subject to overflow; and about once in five years a flood comes, sweeping away houses, fences, and cattle, destroying gardens, and covering the earth with a thick clay, which, instead of enriching the soil, is far poorer than the ancient deposits of sandy loam made before the miners had commenced to tear down the mountains for their golden treasures."

Here we see that the subsoil upturned for gold is carried down by the heavy rains and deposited on the alluvial lands, which are overflowed widely and deeply, because the narrow entrances into the bays cannot pass the waters, and which are becoming more shallow from these deposits of gravel.

These evils lie across the path of California agriculture, and now, before they have become fatal, is the time to remove them. How can this best be done? The history of American agriculture in the Atlantic States furnishes the answer. *Large landed estates,* with their inseparable bad system of cultivation, have been the fruitful cause of an impoverished soil here; but small estates, intelligently cultivated, have been the means of restoring the soil where it could be, and where it could not be, as in the vicinity of Washington, it remains as a warning and an example to all times and places. In California, where the climate favors a much greater annual yield, these estates will admit of a still greater subdivision. But unfortunately the large grants of land made by the Mexican government were recognized by our own government in its treaty stipulations entered into when the agricultural value of California could not have been foreseen. The *value* of these grants in 1848 should have been recognized, but not the grants themselves, for it was the labor and energy of American citizens, and their blood, too, that gave their present value to California lands, and they only should have reaped the benefit.

"Of these grants," says Mr. Hittel, "there are eight hundred and thirteen, covering a total of 9,828,181 acres. Of these claims one hundred and fifty, covering about 3,000,000 acres, have been finally rejected, and a number are as yet undecided. The grants were for large tracts called *ranchos,* intended to be used chiefly or exclusively for pasturage, and the average size was about 12,000 acres, or three square miles."

If these large landed estates had been surveyed by the owners and sold in small tracts at reasonable prices, the evils I have particularized might have been lessened; but a contrary policy has been pursued, for as these grants cover the best agricultural lands, their future value, because of the limited extent of such lands, is regarded as very great, and present asking prices are governed by this future value. The American farmer very justly refuses to settle on lands in any other capacity than as the owner of an untrammelled fee simple. But such a title he cannot obtain in California, and the general effect is seen in the following remarks of Mr. Hittel: "The world never saw such a people of travellers as the Californians. There are now about 350,000 white inhabitants in the State, and more than 250,000 others have gone 'home' during the last twelve years, four-fifths of them never to return. All the men who leave the State do so seeing and acknowledging before they go that in climate, mineral resource, the profits of labor and trade, the enterprise, intelligence, and generosity of the people, the independent spirit of the poor, the democratic spirit of the rich, and the frank friendliness of all, California is far superior to any other part of the American Union, while it has many advantages in other respects." The causes of this unsettled condition are to be found partly in the influence of gold mining, but others are thus alluded to by Mr. Hittel: "The titles of farming land are, as a general thing, insecure." "The questionable character of land titles generally" tends to keep interest high. "The opportunities for investing money securely in California are few compared with other countries, and the chief causes of the difference are to be found in the defects of our land titles and the unsteadiness of business."

Here we behold the evil in its full extent. Uncertain land titles are certain at least in these results: an impoverished soil, and indifferent farm edifices, as well as unsettled business generally; for the security of all occupations of society rests on a flourishing and stable agriculture. And no such agriculture can exist in the United States except the cultivator of the soil is its owner too, secure against even a suspicion of a better claim in another.

The uncertainty of land titles alluded to by Mr. Hittel arises from the recognition of the Mexican grants in the treaty with Mexico. And when a grant is confirmed, the lands embraced within it are withdrawn from market,

hopeless to the tiller of the soil, except at prices which the present profits of agriculture will not justify.

The lands not covered by recognized Mexican grants are: First. Those to which claim has been made under these grants, but which have been determined invalid. Second. Those which are claimed under these grants, but undetermined. Third. The swamp or tule lands owned by the State of California under the legislation of Congress. Fourth. Those granted to the State for school purposes by Congress, and now sold by the State for $1 25 per acre. Fifth. Mining lands reserved from sale as mining lands, but which have been exhausted of their mineral wealth. Sixth. Mining lands reserved from sale, unexhausted.

Some brief observations on each of these will not be improper, in connexion with what has been said on the consequences of recognizing the Mexican grants, in order that a question so important to agriculture as *title* may be completely considered, as it now, and may hereafter affect the agriculture of California.

1. The lands freed from invalid Mexican claims belong to the general government. The homestead policy obtains in California as well as in other States, and should be applied and unswervingly adhered to in the disposal of these lands. It gives the lands to *actual settlers*, not to speculators; in small quantities for cultivation, not to be gathered in masses for future sales. This policy will preserve the soil from deterioration, and it will give stability to the moving population, and, as a consequence, to the general business of California. It will exalt the agriculture of that State, and fit it for that coming demand upon its utmost capabilities which the development of the mining industry will make.

2. The lands claimed under grants not yet determined. The unfortunate treaty stipulations which recognized the validity of these grants must be faithfully regarded; but doubts should be resolved for the public welfare, and against individual aggrandizement. And whatever of these lands are decided to belong to the United States, no special legislation by Congress should arrest the operation of the homestead policy. If its principles are just and beneficial, they should be adhered to; if not, they should have no legal sanction anywhere.

3. The swamp lands owned by the State should be disposed of, not as those of most of the western States have been, for the benefit of speculators, but for the complete fulfilment of the conditions of the grant, and for actual settlement. These lands may come slowly into cultivation, and until they do it is far better that the State should retain the fee simple than speculators.

4. The lands donated to the State for common school purposes. These have been placed in market at $1 25 per acre, and, from all that is disclosed in the Surveyor General's report, are mostly purchased. How far they will have gone into the possession of actual settlers cannot now be determined.

5. Mining lands reserved from sale for mining purposes, but which are exhausted of their mineral wealth. It is stated that these amount to about ten millions of acres, and are susceptible of improvement for agricultural purposes, but especially for fruits and the vine. They lie along the foot of the Nevada and other mountains, having a most delightful climate. These, too, should be surveyed and brought into cultivation under the conditions of the homestead law. For most truly does Mr. Hittel remark: "It is one of the great evils of the tenant-at-will system, that there is little security for the investment of capital. Land should be the main stock of wealth, and the main basis of credit, and the increase of its value with increasing population should be one of the main sources of riches in every new country; but of this kind of property the mining districts are deprived by unwise policy."

6. The great body of California lands not sold are those reserved from sale

as mineral lands. The policy of the government is to prevent them from being absorbed by speculators. This is a just policy, for it favors the laboring classes, and the welfare of these should ever be regarded. Whether the laborer is a miner or a farmer is immaterial; he should not be subjected to the capitalist. But as fast as these lands are exhausted of their minerals, they should be surveyed and disposed of to the actual settler.

From this rapid consideration of the agriculture of California, it will be seen that the chief danger to it lies in the accumulation of its best farming lands in the hands of a few proprietors under the Mexican grants. The power to remove this evil is with the legislature of the State.

AGRICULTURAL EXPORTS OF THIRTY-SEVEN YEARS.

It is proposed in the following tables to give a condensed view of the exports that may properly be termed agricultural, embracing animals and their products; the several varieties of breadstuffs; wood and its products; cotton and its manufactures; and all prominent items of agricultural growth for a period of thirty years, from 1826 to 1855, inclusive, with annual statements from 1856 to 1862, inclusive.

If there may be "sermons in stones," there are whole tomes of political philosophy in these figures. Starting in the first period ending in 1830 with an annual average of fifty millions of dollars, the surplusage of agricultural production after feeding eleven millions of people, American farmers have extended their operations till a population little less than threefold those numbers is fed upon the milk and honey and the wine and oil of a fruitful land, and a surplus is still shown not threefold, but sixfold, one hundred per cent. greater than the increase in population. In view of facts so inspiring well may Bryant exclaim:

> "O country! marvel of the earth,
> O realm to sudden greatness grown."

The following tables exhibit these exports in periods of five years:

Statement of the aggregate exports of the growth and agricultural products of the United States, with their immediate manufactures, for the five years ending June 30, 1830, *and for five years ending June* 30, 1835.

Products and manufactures.	Five years ending 1830.		Five years ending 1835.	
	Quantity.	Value.	Quantity.	Value.
Animals and their products—				
Hogs ..... number..	74, 624	$7, 752, 831	34, 043	$9, 154, 131
Pork ..... barrels..	321, 827		390, 276	
Bacon and hams ..... pounds..	9, 999, 400		8, 087, 628	
Lard ..... do....	34, 808, 205		42, 063, 328	
Horned cattle ..... number..	14, 557	3, 618, 665	34, 630	3, 956, 125
Beef ..... barrels..	328, 153		264, 808	
Tallow ..... pounds..	2, 172, 265		3, 241, 637	
Hides ..... number..	186, 794		511, 272	
Butter ..... pounds..	5, 377, 921	886, 743	6, 345, 847	1, 168, 976
Cheese ..... do....	3, 670, 268		5, 443, 329	
Tallow candles ..... do....	11, 613, 143	3, 848, 419	13, 032, 556	3, 168, 671
Soap ..... do....	32, 265, 477		25, 068, 896	
Horses ..... number..	10, 162	796, 816	12, 592	1, 067, 961
Mules ..... do....	5, 360		5, 779	
Leather and morocco skins	.....	395, 741	.....	162, 647
Leather ..... pounds..	1, 599, 828	2, 071, 621	1, 523, 925	1, 184, 288
Boots and shoes ..... pairs..	1, 979, 578		984, 549	
Sheep ..... number..	45, 291	71, 532	68, 142	123, 916
Skins and furs	.....	2, 818, 665	.....	3, 842, 577
Wax ..... pounds..	2, 460, 752	750, 846	2, 213, 066	535, 931
Apples ..... barrels..	82, 833	125, 583	75, 399	142, 532
Potatos ..... bushels..	461, 226	185, 234	536, 769	215, 386
Cables and cordage ..... cwt..	10, 150	126, 705	16, 667	76, 860
Breadstuffs—				
Indian corn ..... bushels..	3, 530, 710	2, 019, 926	2, 568, 946	1, 804, 711
Indian meal ..... barrels..	783, 408	2, 404, 371	817, 383	2, 731, 077
Wheat ..... bushels..	125, 547	112, 754	614, 145	737, 365
Flour ..... barrels..	4, 651, 940	24, 708, 090	5, 241, 964	29, 347, 649
Rye meal ..... barrels..	110, 520	370, 831	142, 397	556, 736
Rye, oats, &c	.....	368, 797	.....	459, 675
Rice ..... tierces..	721, 933	11, 383, 243	613, 744	11, 245, 919
Biscuit or ship bread	.....	995, 107	.....	1, 212, 230
Cotton—				
Sea Island ..... pounds..	53, 382, 541	133, 122, 182	44, 036, 795	207, 614, 983
Other kinds ..... do....	1, 219, 349, 740		1, 651, 933, 614	
Printed and colored	.....	396, 840	.....	1, 209, 553
White	.....	4, 605, 815	.....	7, 914, 277
Twist, yarn, and thread	.....	63, 473	.....	320, 358
All other manufactures	.....	819, 274	.....	388, 891
Flaxseed ..... bushels..	544, 971	771, 622	711, 862	1, 301, 588
Hemp, all manufactures of	.....	54, 580	.....	45, 455
Ginseng ..... pounds..	1, 644, 851	489, 992	1, 801, 306	563, 829
Hops ..... do....	1, 363, 778	171, 613	2, 461, 854	400, 372
Indigo ..... do....	22, 666	14, 602	1, 433	1, 388
Linseed oil ..... gallons..	37, 226	135, 420	[illegible]4, 395	208, 329
Spirits of turpentine ..... do....	414, 936		411, 815	
Salt ..... bushels..	93, 335	22, 978	331, 282	173, 463
Ale, beer, porter, and cider	.....	933, 429	.....	658, 870
Spirits from grain ..... gallons..	2, 154, 004		1, 415, 050	

Statement of the aggregate exports, &c.—Continued.

Products and manufactures.	Five years ending 1830.		Five years ending 1835.	
	Quantity.	Value.	Quantity.	Value.
Spirits from molasses..........gallons..	2, 178, 625	$568, 849	1, 040, 485	$333, 624
Molasses..............................	....	8, 693	....	13, 617
Sugar, brown.................pounds..	221, 187	16, 812	645, 150	43, 959
Sugar, refined...................do....	2, 740, 464	343, 085	6, 299, 914	612, 240
Tobacco...............................	....	27, 763, 630	....	31, 494, 007
Manufactured..............pounds..	13, 365, 990	1, 109, 048	18, 660, 670	1, 563, 239
Snuff ....do....	192, 202		166, 892	
Wood and its products—				
Staves and heading......thousands..	130, 688	8, 043, 882	161, 537	9, 494, 993
Shingles......................do....	264, 993		190, 406	
Boards, plank and scantling..M feet..	387, 886		433, 287	
Hewn timber ....tons..	73, 616		135, 424	
Other lumber.........................	....	769, 392	....	1, 090, 879
Masts and spars.......................	....	116, 391	....	165, 693
Oak bark and other dye wood	....	631, 810	....	391, 293
Ashes, pot and pearl...........tons..	40, 359	4, 227, 560	43, 059	3, 809, 500
Tar and pitch...............barrels..	263, 414	1, 843, 472	242, 582	2, 450, 646
Rosin and turpentine ....do....	664, 811		843, 908	

Statement of the aggregate exports of the growth and agricultural products of the United States, with their immediate manufactures, for five years ending June 30, 1840, *and for five years ending June* 30, 1845.

Products and manufactures.	Five years ending 1840.		Five years ending 1845.	
	Quantity.	Value.	Quantity.	Value.
Animals and their products—				
Hogs ....number..	8, 333	$7, 667, 610	36, 626	$13, 598, 723
Pork ....barrels..	186, 071		716, 870	
Bacon and hams.............pounds..	6, 648, 224		14, 341, 761	
Lard...........................do....	35, 234, 211		101, 041, 616	
Horned cattle ....number..	16, 780	2, 807, 512	39, 003	6, 947, 865
Beef........................barrels..	137, 663		350, 942	
Tallow ....pounds..	1, 367, 579		35, 445, 571	
Hides ....number..	354, 589		328, 719	
Butter......................pounds..	2, 740, 690	696, 699	16, 088, 814	3, 039, 663
Cheese ....do....	2, 804, 466		22, 929, 554	
Tallow candles................do....	8, 722, 974	2, 290, 528	12, 703, 106	2, 630, 300
Soap.............................do....	14, 768, 011		19, 326, 674	
Horses....................number..	19, 920	1, 584, 348	14, 083	1, 506, 677
Mules ....do....	3, 802		9, 381	
Leather and morocco skins	....	103, 263	....	143, 533
Leather ....pounds..	1, 582, 836	768, 719	2, 786, 761	1, 009, 954
Boots and shoes ....pairs..	366, 505		504, 264	
Sheep ....number..	37, 142	102, 520	67, 249	155, 492
Skins and furs	....	3, 909, 391	....	4, 036, 169
Wax ....pounds..	1, 308, 971	378, 671	2, 839, 201	828, 111
Apples ....barrels..	109, 852	227, 785	131, 213	246, 237
Potatos.....................bushels..	531, 029	266, 218	932, 486	395, 030

Statement of the aggregate exports, &c.—Continued.

Products and manufactures.	Five years ending 1840.		Five years ending 1845.	
	Quantity.	Value.	Quantity.	Value.
Cables and cordage .... cwt..	9,388	$114,785	18,330	$188,495
Breadstuffs—				
Indian corn .... bushels..	1,184,973	873,104	3,474,109	1,755,602
Indian meal .... barrels..	843,930	3,471,215	1,132,749	3,037,021
Wheat .... bushels..	1,842,841	1,817,067	2,946,861	2,900,785
Flour .... barrels..	4,092,932	27,231,952	6,274,697	31,056,156
Rye meal .... do....	170,509	766,604	168,052	545,831
Rye, oats, &c	....	441,253	....	755,045
Rice	585,095	10,982,122	576,336	9,886,144
Biscuit or ship bread	....	1,531,597	....	1,768,939
Cotton—				
Sea Island .... pounds..	35,004,803	321,191,127	36,495,303	256,846,555
Other kinds .... do....	2,586,355,611		3,407,262,371	
Printed and colored	....	1,870,108	....	2,095,604
White	....	12,694,598	....	11,839,756
Twist, yarn, and thread	....	311,398	....	196,940
All other manufactures	....	494,498	....	2,411,192
Flaxseed .... bushels..	336,475	638,585	278,812	240,905
Hemp, all manufactures of	....	78,114	....	29,837
Ginseng .... pounds..	1,115,958	499,057	2,111,864	966,971
Hops .... do....	2,987,332	252,853	3,364,800	331,006
Indigo .... do....	1,324	1,279	5,008	2,486
Linseed oil .... gallons..	19,270	348,036	32,367	277,461
Spirits of turpentine .... do....	762,651		582,078	
Salt .... bushels..	619,687	264,640	655,191	204,997
Ale, beer, porter, and cider	....	698,232	....	286,765
Spirits from grain .... gallons..	997,056		1,105,430	301,058
Spirits from molasses .... do....	1,779,119	653,860	4,363,435	1,194,298
Molasses	....	27,855	....	53,049
Sugar, brown .... pounds..	2,000,634	140,159	931,063	59,632
Sugar, refined .... do....	21,422,176	2,366,822	21,133,413	1,981,074
Tobacco	....	42,963,216	....	42,635,511
Manufactured .... pounds..	22,872,521	2,870,603	26,701,959	2,752,781
Snuff .... do....	241,583		204,743	
Wood and its products—				
Staves and heading .... thousands..	147,721	10,660,991	138,625	9,405,029
Shingles .... do....	190,647		195,612	
Boards, plank, and scantling. M feet..	420,593		494,294	
Hewn timber .... tons..	100,552		84,802	
Other lumber	....	1,312,025	....	1,427,667
Masts and spars	....	155,081	....	168,356
Oak bark and other dyewood	....	866,101	....	445,130
Ashes, pot and pearl .... tons..	31,937	3,319,106	61,503	4,348,115
Tar and pitch .... barrels..	231,604	3,730,509	287,407	3,536,861
Rosin and turpentine .... do....	1,091,290		1,421,936	

Statement of the aggregate exports of the growth and agricultural products of the United States, with their immediate manufactures, for five years ending June 30, 1850, and for five years ending June 30, 1855.

Products and manufactures.	Five years ending 1850.		Five years ending 1855.	
	Quantity.	Value.	Quantity.	Value.
Animals and their products—				
Hogs ....number..	17, 463	$35, 714, 170	1, 947	$37, 003. 990
Pork ....barrels..	1, 087, 208		1, 035, 956	
Bacon and hams ....pounds..	151, 554, 485		126, 306, 607	
Lard........do....	201, 452, 171		148, 875, 693	
Horned cattle........number..	12, 858	10, 478, 118	6, 027	12, 561, 578
Beef........barrels..	563, 514		511, 543	
Tallow ....pounds..	44, 805, 503		38, 084, 359	
Hides........number..	456, 192		306, 409	
Butter........pounds..	17, 684, 596	7, 036, 145	14, 965, 600	4, 957, 536
Cheese........do....	67, 680, 794		32, 626, 083	
Tallow candles........do....	17, 040, 285	3, 199, 305	17, 015, 857	3, 951, 054
Soap ....do....	18, 971, 036		26, 872, 851	
Horses........number..	8, 008	1, 086, 512	6, 548	1, 084, 428
Mules........do....	8, 425		7, 331	
Leather and morocco skins....do....	....	92, 233	....	90, 301
Leather ....pounds..	3, 366, 578	1, 129, 799	5, 613, 207	3, 507, 283
Boots and shoes........pairs..	633, 783		2, 098, 641	
Sheep ....number..	34, 158	112, 284	17, 871	87, 005
Skins and furs........	....	3, 926, 628	....	4, 170, 429
Wax ....pounds..	2, 751, 106	698, 669	1, 703, 953	484, 981
Apples ....barrels..	173, 831	370, 036	141, 613	381, 703
Potatos........bushels..	687, 945	447, 919	703, 561	672, 100
Cables and cordage........cwt..	21, 609	212, 723	66, 819	720, 215
Breadstuffs—				
Indian corn........bushels..	43, 822, 153	31, 277, 920	23, 905, 196	17, 712, 693
Indian meal........barrels..	2, 493, 700	8, 984, 252	1, 121, 456	4, 147, 318
Wheat ....bushels..	10, 184, 643	12, 801, 093	16, 446, 955	21, 684, 702
Flour........barrels..	12, 284, 828	69, 375, 741	13, 149, 518	75, 775, 220
Rye meal ....do..	263, 739	972, 502	130, 574	593, 415
Rye, oats, &c........	....	2, 876, 739	....	1, 436, 136
Rice	....	13, 703, 650	....	10, 651, 689
Biscuit	....	2, 240, 491	....	2, 180, 328
Cotton—				
Sea Island........pounds..	43, 612, 376	296, 563, 066	54, 747, 909	491, 169, 517
Other kinds ....do....	3, 507, 423, 941		5, 073, 547, 896	
Printed and colored........	....	2, 086, 243	....	6, 769, 280
White........	....	17, 920, 316	....	25, 349, 510
Twist, yarn, and thread........	....	470, 538	....	143, 887
All other manufactures........	....	2, 536, 665	....	2, 803, 270
Flaxseed ....bushels..	112, 449	172, 412	52, 986	93, 868
Hemp ....cwt..	6, 493	41, 748	32, 748	280, 977
All manufactures of........	....	41, 958	....	154, 654
Ginseng ....pounds..	2, 124, 132	770, 557	670, 549	373, 570
Hops........do....	3, 458, 842	381, 832	4, 875, 857	1, 495, 215
Indigo ....do....	1, 758	1, 249	5, 364	5. 069
Linseed oil........gallons..	47, 708	1, 367, 226	145, 846	2, 932, 268
Spirits of turpentine........do....	3, 191, 896		5, 370, 518	
Salt ....bushels..	1, 170, 254	204, 202	3, 411, 852	586, 374

Statement of the aggregate exports, &c.—Continued.

Products and manufactures.	Five years ending 1850.		Five years ending 1855.	
	Quantity.	Value.	Quantity.	Value.
Ale, beer, porter, and cider		$317, 491		$269, 158
Spirits from grain ... gallons	1, 101, 682	347, 897	2, 115, 242	890, 786
Spirits from molasses ... do	4, 410, 750	1, 388, 470	8, 314, 189	3, 251, 197
Molasses		55, 682		368, 329
Sugar, brown ... pounds	1, 490, 406	89, 552	10, 802, 687	593, 745
Sugar, refined ... do	13, 789, 617	1, 185, 093	21, 829, 099	1, 642, 240
Tobacco		38, 326, 708		55, 298, 367
Manufactured ... pounds	34, 475, 935	3, 177, 175	46, 130, 637	7, 183, 109
Snuff ... do	220, 209		244, 359	
Wood and its products—				
Staves and headings ... M	127, 546	10, 813, 045	214, 853	17, 640, 509
Shingles ... M	183, 039		193, 207	
Boards, plank, and scantling ... M ft	433, 279		621, 770	
Hewn timber ... tons	67, 792		177, 686	
Other lumber		1, 119, 366		1, 295, 292
Masts and spars		314, 991		425, 704
Oak bark and other dyewood		642, 026		829, 556
Ashes, pot and pearl ... tons	30, 696	2, 908, 639	21, 204	2, 262, 312
Tar and pitch ... barrels	386, 348	4, 585, 113	402, 357	7, 795, 265
Rosin and turpentine ... do	1, 712, 516		2, 623, 469	

RECAPITULATION.—STATEMENT OF PERIODS.

Products and manufactures.	Five years ending 1830.	Five years ending 1835.	Five years ending 1840.	Five years ending 1845.	Five years ending 1850.	Five years ending 1855.
	Value.	Value.	Value.	Value.	Value.	Value.
Animals and their products	$23, 011, 879	$24, 365, 223	$20, 309, 261	$33, 896, 486	$63, 473, 863	$67, 898, 685
Breadstuffs	42, 363, 119	48, 095, 362	47, 114, 914	51, 705, 513	142, 232, 388	134, 181, 567
Wood and its products	15, 632, 507	17, 403, 004	20, 043, 813	19, 331, 158	20, 383, 180	30, 248, 638
Cotton and its manufactures	139, 007, 584	217, 448, 062	336, 561, 729	273, 390, 047	319, 576, 828	526, 235, 464
Miscellaneous	32, 841, 875	37, 848, 758	52, 412, 149	52, 147, 603	48, 999, 940	77, 192, 944

ANNUAL AVERAGE FOR EACH PERIOD OF FIVE YEARS.

Animals and their products	$4, 602, 375	$4, 873, 044	$4, 061, 852	$6, 779, 297	$12, 694, 772	$13, 579, 737
Breadstuffs	8, 472, 623	9, 619, 072	9, 422, 982	10, 341, 102	28, 446, 477	26, 836, 313
Wood and its products	3, 126, 501	3, 490, 600	4, 008, 762	3, 866, 231	4, 076, 636	6, 049, 727
Cotton and its manufactures	27, 801, 516	43, 489, 612	67, 312, 345	54, 678, 009	63, 915, 365	105, 247, 092
Miscellaneous	6, 568, 375	7, 569, 751	10, 482, 429	10, 429, 520	9, 799, 988	15, 438, 588
Total annual average	50, 571, 390	69, 032, 079	95, 288, 370	86, 094, 159	118, 933, 238	167, 151, 457

The annual averages above will be found interesting in a comparison with the recapitulation of the following tables:

Statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June 30, 1856, *and June* 30, 1857.

Products and manufactures.	1856.		1857.	
	Quantity.	Value.	Quantity.	Value.
Of animals—				
Hogs ... number	1,391	$6,331	923	$5,525
Pork ... tierces	4,484	5,029,940	442	2,805,867
Pork ... barrels	274,669		143,850	
Hams and bacon ... pounds	41,748,092	3,863,328	43,863,530	4,511,442
Lard ... do	37,582,271	3,870,949	40,246,544	5,144,195
Lard oil ... gallons	212,262	161,232	91,432	92,490
Horned cattle ... number	2,478	133,743	4,325	144,840
Beef ... tierces	46,795	1,983,151	15,930	1,218,348
Beef ... barrels	56,996		54,445	
Tallow ... pounds	7,458,471	829,086	5,698,315	632,286
Hides ... number	40,184	101,174	153,726	624,867
Butter ... pounds	2,936,491	580,286	3,141,592	593,084
Cheese ... do	8,737,029	887,705	6,453,072	647,423
Candles ... do	4,548,373	815,037	4,255,146	712,519
Soap ... do	6,348,298	434,176	7,484,085	530,085
Horses ... number	2,250	204,608	1,631	195,627
Mules ... do	1,144	119,364	1,624	171,189
Leather and morocco skins	...	5,765	...	2,119
Leather ... pounds	972,768	252,344	1,746,546	497,714
Boots and shoes ... pairs	683,149	1,060,967	561,501	813,995
Sheep ... number	3,520	18,802	4,373	22,758
Wool ... pounds	145,115	27,455	50,202	19,007
Skins and furs	...	952,452	...	1,116,041
Wax ... pounds	270,320	74,005	315,378	91,983
Apples ... barrels	74,287	143,884	33,201	135,280
Potatos ... do	82,512	153,061	86,808	205,616
Onions	...	83,742	...	77,048
Breadstuffs—				
Indian corn ... bushels	10,292,280	7,622,565	7,505,318	5,184,666
Indian meal ... barrels	293,607	1,175,688	267,504	957,791
Wheat ... bushels	8,154,877	15,115,661	14,570,331	22,240,857
Flour ... barrels	3,510,626	29,275,148	3,712,053	25,882,316
Rye meal ... do	38,105	214,563	27,023	115,828
Rye, oats, &c	...	2,718,620	...	680,108
Rice	...	2,390,233	...	2,290,400
Biscuit or ship bread	...	497,741	...	563,266
Cables and cordage ... cwt	31,760	367,182	36,270	286,163
Cotton—				
Sea Island ... pounds	12,797,225	128,382,351	12,940,725	131,575,859
Other kinds ... do	1,338,634,476		1,035,341,750	
Cotton piece goods—				
Printed or colored	...	1,966,845	...	1,785,685
White, other than duck	...	4,290,361	...	3,463,230
Duck	...	325,903	...	252,109
All other manufactures of	...	384,200	...	614,153
Clover seed	...	41,875	...	330,166
Flaxseed ... bushels	10,415	18,043	350	525
Linseed oil ... gallons	62,469	57,190	58,114	54,144

Statement of the exports, &c.—Continued.

Products and manufactures.	1856.		1857.	
	Quantity.	Value.	Quantity.	Value.
Oil cake		$1, 136, 970		$1, 186, 980
Hemp ... cwt..	3, 648	28, 598	7, 325	46, 907
Cloth and thread		802		1, 066
Bags and other manufactures		25, 233		23, 687
Ginseng ... pounds..	350, 961	175, 705	134, 562	58, 331
Hops ... do....	1, 048, 515	146, 966	924, 538	84, 852
Spirits of turpentine ... gallons..	1, 844, 560	839, 048	1, 522, 177	741, 346
Salt ... bushels..	698, 458	311, 495	576, 151	190, 699
Spirits from grain ... gallons..	897, 348	500, 945	2, 167, 924	1, 248, 234
Beer, ale, porter, and cider		45, 086		43, 732
Spirits from molasses ... gallons..	2, 692, 497	1, 329, 151	2, 378, 603	1, 216, 635
Spirits from other materials ... do....	149, 809	95, 484	169, 226	120, 011
Molasses ... do....	454, 315	154, 630	207, 931	108, 003
Vinegar ... do....	179, 419	26, 034	230, 065	30, 788
Sugar, brown ... pounds..	5, 170, 819	404, 145	2, 196, 412	190, 012
Sugar, refined ... do....	4, 100, 372	360, 444	3, 141, 835	368, 206
Tobacco		12, 221, 843		20, 260, 772
Tobacco, manufactured ... pounds..	10, 008, 606	1, 809, 157	7, 456, 666	1, 447, 027
Snuff ... do....	86, 055	20, 050	50, 401	11, 526
Wood and its products—				
Staves and headings ... M..	73, 311	1, 864, 281	65, 579	2, 055, 980
Shingles ... M..	45, 173	166, 207	70, 646	212, 805
Boards, plank, and scantling.. M ft..	126, 330	1, 987, 302	309, 165	4, 170, 686
Hewn timber ... tons..	34, 260	234, 969	68, 265	516, 735
Other lumber		803, 684		638, 406
Oak bark and other dyewood		121, 030		323, 754
Ashes, pot and pearl ... tons..	3, 355	429, 428	5, 768	696, 367
Tar and pitch ... barrels..	87, 765	235, 487	96, 731	208, 610
Rosin and turpentine ... do..	524, 799	1, 222, 066	641, 517	1, 544, 572
All other manufactures of wood		2, 501, 583		3, 158, 424

Statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June, 30, 1858, *and June* 30, 1859.

Products and manufactures.	1858.		1859.	
	Quantity.	Value.	Quantity.	Value.
Of animals—				
Hogs ... number..	96, 000	$810, 406	95, 509	$550, 875
Pork ... tierces..	5, 693	2, 852, 942	3, 322	3, 355, 746
Pork ... barrels.	151, 335		200, 759	
Hams and bacon ... pounds..	20, 954, 374	1, 957, 423	11, 989, 694	1, 263, 042
Lard ... do....	33, 022, 286	3, 809, 501	28, 362, 706	3, 268, 406
Lard oil ... gallons..	68, 342	60, 958	56, 675	50, 793
Horned cattle ... number..	28, 247	1, 238, 769	32, 513	1, 345, 058
Beef ... tierces..	37, 700	2, 081, 856	51, 658	2, 188, 056
Beef ... barrels.	63, 257		76, 518	

Statement of the exports, &c.—Continued.

Products and manufactures.	1858.		1859.	
	Quantity.	Value.	Quantity.	Value.
Of animals—Continued.				
Tallow ....pounds..	8, 283, 812	$824, 970	7, 103, 045	$712, 551
Hides	....	875, 753	....	520, 599
Butter.....................pounds..	3, 082, 117	541, 863	4, 572, 065	750, 9[illegible]1
Cheese.........................do....	8, 098, 527	731, 910	7, 103, 323	649, 302
Candles........................do....	3, 953, 454	694, 611	4, 425, 861	718, 028
Soap...........................do....	4, 738, 981	305, 704	6, 568, 101	466, 215
Horses...................number..	2, 154	283, 371	2, 295	290, 250
Mules..........................do....	2, 261	244, 297	2, 282	258, 336
Leather and morocco skins	....	13, 099	....	41, 465
Leather ....pounds..	2, 505, 367	605, 589	2, 063, 040	499, 718
Boots and shoes ....pairs..	609, 982	663, 905	627, 850	820, 175
Sheep	....	49, 319	....	41, 182
Wool.......................pounds..	884, 807	211, 861	1, 706, 536	355, 563
Skins and furs......................	....	1, 002, 378	....	1, 361, 352
Wax ....pounds..	366, 246	85, 926	290, 374	94, 850
Apples ....barrels..	27, 711	74, 363	32, 979	99, 803
Potatos....................bushels..	242, 231	205, 791	376, 056	284, 111
Onions	....	75, 626	....	100, 669
Breadstuffs—				
Indian corn...............bushels..	4, 766, 145	3, 259, 039	1, 719, 998	1, 323, 103
Indian meal...............barrels..	237, 637	877, 692	258, 885	994, 269
Wheat ....bushels..	8, 926, 196	9, 061, 504	3, 002, 016	2, 849, 192
Flour.....................barrels..	3, 512, 169	19, 328, 884	2, 431, 824	14, 433, 591
Rye meal ....do....	14, 283	56, 235	14, 432	50, 786
Rye, oats, &c.......................	....	642, 764	....	1, 181, 170
Rice	....	1, 870, 578	....	2, 207, 148
Biscuit or ship bread	....	472, 372	....	512, 910
Cables and cordage.................cwt..	18, 424	212, 840	31, 721	320, 435
Cotton—				
Sea Island.................pounds..	12, 101, 058	131, 386, 661	13, 713, 556	161, 434, 923
Other kinds ....do....	1, 106, 522, 954		1, 372, 755, 006	
Cotton piece goods—				
Printed or colored	....	2, 069, 194	....	2, 320, 890
White, other than duck	....	1, 598, 136	....	1, 302, 381
Duck................................	....	183, 889	....	215, 855
All other manufactures of...........	....	1, 800, 285	....	4, 477, 096
Clover seed...............bushels..	76, 316	332, 250	95, 939	536, 781
Flaxseed ....do....	....	....	5, 667	8, 177
Linseed oil...............gallons..	65, 398	48, 225	41, 998	34, 194
Oil cake	....	1, 435, 861	....	1, 198, 581
Hemp ....tons..	419	47, 875	108	9, 279
Manufactures of	....	89, 092	....	18, 878
Ginseng ....pounds..	366, 053	193, 736	110, 426	54, 204
Hops ....do....	458, 889	41, 704	587, 953	53, 016
Spirits of turpentine.....gallons..	2, 457, 235	1, 089, 282	2, 682, 230	1, 306, 035
Salt......................bushels..	533, 100	162, 650	717, 257	212, 710
Spirits from grain........gallons..	1, 000, 997	476, 722	557, 313	273, 576
Beer, ale, porter and cider.........	....	59, 532	....	78, 226
Spirits from molasses.....gallons..	3, 508, 071	1, 267, 691	2, 243, 348	760, 889
Spirits from other materials ....do....	515, 667	249, 432	355, 752	188, 746
Molasses ....do....	290, 046	115, 893	181, 341	75, 699

Statement of the exports, &c.—Continued.

Products and manufactures.	1858.		1859.	
	Quantity.	Value.	Quantity.	Value.
Vinegar .... gallons..	201, 024	$24, 336	265, 000	$35, 156
Sugar, brown .... pounds..	5, 410, 225	375, 062	2, 582, 718	196, 935
Sugar, refined .... do....	1, 790, 895	200, 724	3, 976, 030	377, 944
Tobacco	....	17, 009, 767	....	21, 074, 038
Tobacco, manufactured .... pounds..	11, 210, 574	2, 400, 115	14, 912, 811	3, 334, 401
Snuff .... do....	37, 245	10, 109	239, 148	63, 090
Wood and its products—				
Staves and headings .... M..	87, 186	1, 975, 852	131, 916	2, 410, 334
Shingles .... M..	195, 170	595, 451	57, 815	191, 531
Boards, plank, and scantling ... M ft..	217, 861	3, 428, 530	197, 099	3, 317, 298
Hewn timber .... tons..	41, 474	292, 163	48, 849	367, 609
Other lumber	....	1, 240, 425	....	1, 001, 216
Oak bark and other dye-wood	....	392, 825	....	412, 701
Ashes, pot and pearl .... cwt..	79, 168	554, 744	100, 617	643, 861
Tar and pitch .... barrels..	42, 675	100, 679	64, 256	141, 058
Rosin and turpentine .... do....	574, 573	1, 464, 210	798, 083	2, 248, 381
All other manufactures of wood	....	2, 234, 678	....	2, 339, 861

Statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June 30, 1860, *and June* 30, 1861.

Products and manufactures.	1860.		1861.	
	Quantity.	Value.	Quantity.	Value.
Of animals—				
Hogs .... number..	48, 355	$377, 604	463	$3, 267
Pork .... tierces....	1, 616	3, 132, 313	1, 682	2, 609, 818
Pork .... barrels ...	202, 319		153, 964	
Hams and bacon .... pounds..	25, 844, 610	2, 273, 768	50, 264, 267	4, 848, 339
Lard .... do....	40, 289, 519	4, 545, 831	47, 908, 911	4, 729, 297
Lard oil .... gallons..	60, 209	55, 783	85, 676	81, 783
Horned cattle .... number..	27, 501	1, 052, 426	8, 885	223, 246
Beef .... tierces....	78, 674	2, 674, 324	41, 822	1, 675, 773
Beef .... barrels ...	76, 283		65, 468	
Tallow .... pounds..	15, 269, 535	1, 598, 176	29, 718, 364	2, 942, 736
Hides	....	1, 036, 260	....	673, 818
Butter .... pounds..	7, 640, 914	1, 144, 321	15, 531, 381	2, 355, 985
Cheese .... do....	15, 515, 799	1, 565, 630	32, 361, 428	3, 321, 631
Candles .... do....	5, 033, 335	760, 528	5, 025, 667	826, 955
Soap .... do....	6, 852, 485	494, 405	7, 202, 130	455, 648
Horses .... number..	1, 635	233, 368	1, 469	193, 420
Mules .... do....	1, 435	158, 080	1, 799	191, 873
Leather and morocco skins	....	19, 011	....	7, 507
Leather .... pounds..	2, 946, 633	674, 309	2, 714, 466	555, 202
Boots and shoes .... pairs..	678, 136	782, 525	655, 808	779, 876
Sheep	....	33, 613	....	28, 417
Wool .... pounds..	1, 055, 928	389, 512	847, 301	237, 846
Skins and furs	....	1, 533, 208	....	878, 466
Wax .... pounds..	362, 474	131, 803	270, 425	94, 795

Statement of the exports, &c.—Continued.

Products and manufactures.	1860.		1861.	
	Quantity.	Value.	Quantity.	Value.
Apples .... barrels..	78, 809	$206, 055	112, 523	$269, 363
Potatos .... bushels..	380, 372	284, 673	413, 091	285, 503
Onions	....	109, 861	....	102, 578
Breadstuff—				
Indian corn .... bushels..	3, 314, 155	2, 399, 808	10, 678, 244	6, 890, 865
Indian meal .... barrels..	233, 709	912, 075	203. 313	692, 003
Wheat .... bushels..	4, 155, 153	4, 076, 704	31, 238, 057	38, 313, 624
Flour .... barrels..	2, 611, 596	15, 448, 507	4, 323, 756	24, 645, 849
Rye meal .... do....	11, 432	48, 172	14, 143	55, 761
Rye, oats, &c	....	1, 058, 304	....	1, 124, 556
Rice	....	2, 567, 399	....	1, 382, 178
Biscuit or ship bread	....	478, 740	....	429, 708
Cables and cordage .... cwt..	26, 053	246, 572	28, 422	255, 274
Cotton—Sea Island .... pounds..	15, 598, 698	191, 806, 555	6, 170, 321	34, 051, 483
Other kinds .... do....	1, 752, 087, 640		301, 345, 778	
Cotton piece goods—				
Printed or colored	....	3, 356, 449	....	2, 215, 032
White, other than duck	....	1, 403, 506	....	10, 076, 959
Duck	....	382, 089	....	300, 668
All other manufactures of	....	5, 792, 752	....	4, 364, 379
Clover seed .... bushels..	116, 574	596, 919	200, 417	1, 063, 141
Flaxseed .... do....	2, 715	3, 810	28, 540	49, 609
Linseed oil .... gallons..	37, 809	26, 799	42, 638	27, 982
Oil cake	....	1, 609, 328	....	1, 386, 691
Hemp .... tons..	186	9, 531	136	8, 608
All manufactures of	....	27, 814	....	39, 570
Ginseng .... pounds..	395, 909	295, 766	347, 577	292, 899
Hops .... do....	273, 257	32, 866	8, 835, 837	2, 006, 053
Spirits of turpentine .... gallons..	4, 072, 023	1, 916, 289	2, 941, 855	1, 192, 787
Salt .... bushels..	475, 445	129, 717	537, 401	144, 046
Beer, ale, porter and cider	....	53, 573	....	39, 480
Spirits from grain .... gallons..	748, 135	311, 595	2, 294, 181	867, 954
Spirits from molasses .... do....	2, 855, 952	930, 644	2, 885, 869	850, 546
Spirits from other materials .... do....	494, 643	219, 199	1, 362, 414	593, 185
Molasses .... do....	79, 439	35, 292	91, 593	39, 138
Vinegar .... do....	340, 257	41, 368	315, 994	38, 262
Sugar, brown .... pounds..	1, 133, 986	103, 244	3, 275, 024	301, 329
Sugar, refined .... do....	3, 332, 045	301, 674	3, 236, 110	287, 831
Tobacco	....	15, 906, 547	....	13, 784, 710
Tobacco, manufactured	17, 697, 309	3, 372, 974	14, 783, 363	2, 742, 828
Snuff .... pounds..	39, 923	11, 354	81, 465	17, 703
Wood and its products—				
Staves and heading .... thousand..	75, 800	2, 365, 516	73, 408	1, 959, 392
Shingles .... do....	41, 601	169, 546	30, 078	108, 610
Boards, plank, and scantling . M feet..	170, 922	2, 777, 919	132, 332	2, 092, 949
Hewn timber .... tons..	32, 376	231, 668	8, 821	97, 875
Other lumber	....	705, 119	....	441, 979
Oak bark and other dye-wood	....	164, 260	....	189, 476
Ashes, pot and pearl .... cwt..	271, 949	822, 820	99, 701	651, 547
Tar and pitch .... barrels..	60, 623	151, 404	55, 057	143, 280
Rosin and turpentine .... do....	770, 652	1, 818, 238	536, 207	1, 060, 257
All other manufactures of wood	....	2, 703, 095	....	2. 344, 079

Statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the year ending June 30, 1862.

Products and manufactures.	Quantity.	Value.
Of animals—		
Hogs .... number..	3, 306	$23, 562
Pork .... tierces..	2, 102	3, 980, 153
barrels.	305, 949	
Hams and bacon .... pounds..	141, 212, 786	10, 290, 572
Lard .... do....	118, 573, 307	10, 004, 521
Lard oil .... gallons..	239, 608	148, 056
Horned cattle .... number..	3, 634	197, 019
Beef .... tierces....	57, 234	2, 017, 077
barrels ...	50, 171	
Tallow .... pounds..	46, 773, 768	4, 026, 113
Hides	....	518, 687
Butter .... pounds..	26, 691, 247	4, 164, 344
Cheese .... do....	34, 052, 678	2, 715, 892
Candles, adamantine and other .... do....	5, 819, 503	836, 849
Candles, sperm .... do....	280, 526	64, 481
Soap .... do....	9, 986, 984	636, 049
Horses .... number..	1, 534	157, 442
Mules .... do....	3, 237	212, 187
Leather and morocco skins	....	13, 049
Leather .... pounds..	1, 775, 556	389, 007
Boots and shoes .... pairs..	679, 594	721, 241
Sheep	....	34, 600
Wool .... pounds..	1, 153, 388	296, 225
Skins and furs	....	794, 407
Wax .... pounds..	142, 312	47, 383
Apples .... barrels..	66, 767	238, 923
Potatos .... bushels..	417, 138	300, 599
Onions	....	90, 412
Breadstuffs—		
Indian corn .... bushels..	18, 904, 898	10, 387, 383
Indian meal .... barrels..	253, 570	778, 344
Wheat .... bushels..	37, 289, 572	42, 573, 295
Flour .... barrels..	4, 882, 033	27, 534, 677
Rye meal .... do....	14, 463	54, 488
Rye, oats, &c	....	2, 364, 625
Rice	....	156, 899
Biscuit, or ship bread	....	490, 942
Cables and cordage .... cwt..	19, 690	199, 669
Cotton—		
Sea Island .... pounds..	66, 443	1, 180, 113
Other kinds .... do....	4, 998, 121	
Cotton piece goods—		
Printed or colored	....	578, 500
White, other than duck	....	508, 004
Duck	....	221, 685
All other manufactures of	....	1, 629, 275
Clover seed .... bushels..	66, 064	299, 255
Flaxseed .... do....	15	59
Linseed oil .... gallons..	25, 062	20, 893
Oil cake	....	875, 841
Hemp .... tons..	124	8, 300

Statement of the exports, &c.—Continued.

Products and manufactures.	Quantity.	Value.
Hemp, all manufactures of		$31, 940
Ginseng ..... pounds	630, 714	408, 590
Hops ..... do	4, 851, 246	663, 308
Spirits of turpentine ..... gallons	43, 507	54, 691
Salt ..... bushels	397, 506	228, 109
Beer, ale, porter, and cider		54, 696
Spirits from grain ..... gallons	768, 295	328, 834
Spirits from molasses ..... do	2, 496, 220	715, 694
Spirits from other materials ..... do	3, 956, 359	1, 577, 909
Molasses ..... do	45, 009	21, 914
Vinegar ..... do	268, 927	29, 701
Sugar, brown ..... pounds	1, 284, 849	90, 022
Sugar, refined ..... do	1, 470, 403	147, 397
Tobacco		12, 325, 356
Tobacco, manufactured ..... pounds	4, 071, 963	1, 068, 730
Snuff ..... do	38, 839	7, 914
Wood and its products—		
Staves and heading ..... thousand	69, 965	2, 590, 649
Shingles ..... do	20, 118	67, 356
Board, plank, and scantling ..... M feet	129, 243	2, 015, 982
Hewn timber ..... tons	4, 391	138, 521
Other lumber		1, 162, 753
Oak bark and other dye		186, 363
Ashes, pot and pearl ..... cwt	74, 895	457, 049
Tar and pitch ..... barrels	9, 765	55, 884
Rosin and turpentine ..... do	65, 441	293, 400
All other manufactures of wood		1, 755, 793

RECAPITULATION—ANNUAL STATEMENTS.

	1856.	1857.	1858.	1859.
Animal productions	$21, 411, 900	$20, 593, 413	$19, 946, 411	$17, 602, 413
Breadstuffs	59, 010, 219	57, 915, 232	35, 569, 068	23, 562, 169
Wood and its products	9, 566, 037	13, 525, 339	12, 279, 597	13, 073, 850
Cotton and its manufactures	135, 349, 660	137, 691, 036	137, 038, 165	169, 751, 145
Miscellaneous	20, 497, 763	28, 477, 756	26, 198, 678	30, 700, 573
Total	245, 835, 579	258, 202, 776	231, 031, 919	254, 690, 150

Recapitulation—Continued.

	1860.	1861.	1862.
Animal productions	$24, 666, 798	$27, 715, 392	$42, 288, 916
Breadstuffs	26, 989, 709	73, 534, 544	84, 340, 653
Wood and its products	12, 909, 585	9, 080, 434	8, 723, 750
Cotton and its manufactures	202, 741, 351	51, 008, 521	4, 117, 577
Miscellaneous	26, 783, 464	26, 687, [illegible]	19, 788, 756
Total	293, 590, 907	[illegible]	159, 259, 652

The most remarkable feature in this summary is the extraordinary development of the foreign trade in breadstuffs. The animal productions of the country take the next rank. Cotton occupies the third place in relative increase since 1825. The following is a statement of the proportionate rate of increase in thirty-seven years under the several heads of the classification:

Breadstuffs	895 per cent.
Animal productions	818 "
Cotton and its manufactures (to 1860)	629 "
Miscellaneous products	199 "
Wood and its products	178 "

In 1860 the total of agricultural exports, exclusive of cotton, was $90,849,556; in 1861, when the cotton-State ports were closed for three-fourths of the year, the same exports increased to $137,026,505, an increase of $46,176,949—about fifty-one per cent. advance during the first year of the rebellion, when the commercial marine of the country was largely diverted to the naval service, when the ports of a great section were blockaded, and the very existence of the government was threatened by a monstrous insurrection. In 1862 a further increase of $18,115,570 was made, the aggregate being $155,142,075. The advance was mainly in provisions and breadstuffs, (mostly breadstuffs,) and was occasioned by a diversion of trade from the south to Europe, and to some extent by decreased breadth and yield of wheat in England and other European states. The total of animal products in 1860 was $24,666,798; in 1861, $27,715,392; in 1862, $42,288,916. Breadstuffs made a stride from $26,989,709 to $73,534,544 in 1861, and to $84,340,653 in 1862—an increase of more than two hundred per cent. The principal increase is found in the following items:

	1860.	1861.	1862.
Indian corn	$2,399,808	$6,890,865	$10,387,383
Wheat	4,076,704	38,313,624	42,573,295
Flour	15,448,507	24,645,849	27,534,677

Without reflection one might deem such a result, in the absence of southern exports, so wonderful as to excite suspicions of the truthfulness of the figures. It should be remembered that, cotton excepted, and rice and tobacco left out, the exports from southern ports have mainly been the produce of the west shipped *via* New Orleans, and are scarcely worth taking into the account of general agricultural exports.

The following table shows the paucity of such exports:

Statement of the aggregate exports of the growth and agricultural products (with the exception of cotton) of the collection districts of Richmond, Norfolk, Petersburg, Alexandria, Camden, Edenton, Plymouth, Washington, Newbern, Beaufort, Wilmington, Charleston, Georgetown, Savannah, Brunswick, Mobile, Pensacola, Key West, St. John's, Apalachicola, Fernandina, New Orleans, and Texas, for the year ending June 30, 1860.

Products and manufactures.	New Orleans.	All other.	Total value.
	Value.	Value.	
Of animals—			
Pork	$67, 869	$5, 307	$73, 176
Hams and bacon	93, 323	6, 139	99, 462
Lard	1, 228, 793	26, 565	1, 255, 358
Lard oil	1, 789		1, 789
Horned cattle		56, 522	56, 522
Beef	87, 461	3, 750	91, 211
Tallow	188, 696	6, 163	194, 859
Butter	14, 332	2, 687	17, 019
Cheese	10, 174	196	10, 370
Candles	16, 765	3, 087	19, 852
Soap	2, 373	547	2, 920
Horses	20, 512	41, 950	62, 462
Leather	305		305
Boots and shoes	4, 128	240	4, 368
Sheep	40		40
Wool		925	925
Skins and furs	350		350
Wax	3, 452	159	3, 611
Apples	467	134	601
Potatos	20, 580	8, 115	28, 695
Onions	4, 034	120	4, 154
Breadstuffs—			
Indian corn	180, 778	80, 138	260, 916
Indian meal	307	5, 710	6, 017
Wheat	3, 222	51, 694	54, 916
Flour	515, 852	2, 060, 637	2, 576, 489
Rye, oats, &c	9, 042	13, 991	23, 033
Rice	31, 678	1, 160, 097	1, 191, 775
Biscuit or ship-bread	5, 563	10, 656	16, 219
Cables and cordage	1, 624		1, 624
Flaxseed	86		86
Linseed oil	747		747
Oilcake	48, 620		48, 620
Spirits of turpentine	5, 482	465, 154	470, 636
Beer, ale, porter, and cider	1, 425	400	1, 825
Spirits from grain	3, 973		3, 973
Spirits from molasses	769	32	801
Spirits from other materials	1, 094	282	1, 376
Molasses	168		168
Sugar, brown	1, 508		1, 508
Sugar, refined	4, 101		4, 101
Tobacco	7, 434, 909	3, 079, 661	10, 514, 570
Tobacco, manufactured	7, 753	28, 162	35, 915
Snuff	3, 803		3, 803

Statement of the aggregate exports, &c.—Continued.

Products and manufactures.	New Orleans.	All other.	Total value.
	Value.	Value.	
Wood and its products—			
Staves and headings	$410,169	$271,515	$681,684
Shingles	2,433	77,779	80,212
Board, plank, and scantling	11,559	912,400	923,959
Hewn timber	2,935	226,490	229,425
Other lumber	16,979	188,112	205,091
Oak bark and other dyewood		851	851
Ashes, pot and pearl	166		166
Tar and pitch	2,746	23,914	26,660
Rosin and turpentine	43,942	291,912	335,854
All other manufactures of wood	86,746	40,550	127,296
Total	10,585,622	9,152,743	19,738,365

Of this total more than half ($10,585,622,) went from New Orleans. A glance at the figures—a million and a quarter in corn, half a million in flour, and other items of provisions and breadstuffs—will show the source of production of New Orleans exports, exclusive of tobacco.

It will be seen that more than half their value consists in two items, viz:

Tobacco and snuff	$10,554,288
Rice	1,191,775
Total	11,746,063
Leaving for all other exports	7,992,302

The strange hallucination that affected superficial minds (strengthened and deepened as it was by designing men for an object) that upon cotton rested the prosperity of the country, has already been dispelled. The mere size of the cotton item in the export tables was sufficient to blind the perceptions of the great majority of people. They forgot that the raw cotton export, even in its highest showing in 1860, was but $191,806,555, about one-twelfth of the amount of the census enumeration of agricultural products, including a fair estimate of the production of domestic animals, and scarcely one-fifteenth of the actual total agricultural product of the United States, when all unenumerated articles are added to the imperfect census returns. A little extra attention given to the growing of cereals, sorghum, and the production of domestic animals, would more than compensate for the loss of every pound of cotton at its highest estimate of commercial or intrinsic value; and the hiatus occasioned in textile supply would be filled by other products, if necessary, with a surprisingly small amount of public inconvenience, and in a space of time incredibly small. Such is our remarkable facility for adaptation to new circumstances, that the total loss of any product, however important, will ever be compensated for by some new development of productive industry.

It will be readily seen that if the cotton States produced, for example, one-fifth of the whole country's annual increase in agricultural wealth all in cotton and all of it exported, while the remainder of the States produced the

other four-fifths, fed their people and those of the cotton States, and exported nothing, that it would be absurd to estimate the annual value of agricultural labor of any particular section by its amount of exports.

We should learn to depreciate the value of no branch of American industry, but seek properly to estimate the intrinsic commercial worth and bearings of all.

DONATIONS TO THE DEPARTMENT OF AGRICULTURE.

FROM SEPTEMBER 1, 1862, TO JUNE 30, 1863.

Date.	Articles donated.	From whom.	Residence.
1862.			
Sept. 5	Cuepern grapes for chemical analysis	C. J. Ullman	Washington city, D. C.
29	Currant seed, (four varieties)	Gov. Jas. D. Doty, Utah T'y.	Great Salt Lake City.
Oct. 10	California barley and Java spring wheat	S. Dillingham	West Falmouth, Mass.
13	Hybrid sweet corn	M. C. Read	Hudson, Ohio.
25	White winter wheat, (superior specimen)	Charles Esslinger	Manitowoc, Wis.
25	Mixed white wheat	do	Do.
25	Rio Grande wheat	do	Do.
30	Perennial cotton seed, (specimen)	Hon. Allen A. Burton, United States minister.	Bogota, New Granada.
30	Catawba wine for chemical analysis	G. Blochlinger	Dubuque, Iowa.
30	Currant wine for chemical analysis	do	Do.
30	Catawba grapes	do	Do.
Nov. 5	Flower seeds	Mrs. George S. McKiernan	Louisville, Ky.
5	Mammoth specimens of onions and potatos	Hon. H. P. Bennett	Denver, Colorado Ter.
6	Black, white, and red corn, new variety		Dakota Territory.
6	California wines, (several brands)	Perkins & Sterne	New York city.
7	Beautiful specimen of Sea Island cotton	Com. S. B. Bissell, U. S. N.	Pisco, Peru.
7	Beautiful specimen of Llama, Alpacca, and Vicuna wool.	do	Do.
10	Specimen of white wheat	Hon. H. P. Bennett	Denver, Colorado Ter.
13	Cotton grown in Illinois	Wm. H. Osborne, president Illinois Central Railr'd Co.	Chicago, Ill.
13	Coolie Mandarin orange seeds	S. W. Williams	Washington, D. C.
14	Superior specimen of Pearl barley	Theodore Clark	Edinburg, Ohio.
22	Sample black Swedish oats	Chas. A. Leas, United States consul.	Stockholm, Sweden.
22	Grape cuttings	J. W. Asbach	New Buda.
22	Grape cuttings, several varieties	Augustus Pratt	North Middleboro', Mass.
28	Sample of cotton grown in Maryland	F. B. Green	Charles county, Md.
Dec. 1	Curious and interesting specimens of printing, writing, tracing, and wrapping paper; also thread, cloth, &c., manufactured from the maize plant.	Dr. Alois R. Auer	Welsbach, Austria.
4	Sequoia, or Wellingtonia gigantea seeds	Silliman & Dana	New Haven, Conn.
5	Delaware grape cuttings	G. Hartshorne	Rahway, N. J.
5	Grape cuttings, several choice varieties	Jacob R. Shotwell	Do.
6	Janney corn, new variety	S. L. Pancoast	Camden county, N. J.
9	White corn, superior sample	do	Do.
18	Poppy seed	A. A. Moss	Philadelphia, Pa.

Date.	Articles donated.	From whom.	Residence.
1862.			
Dec. 20	China tea wheat, (spring variety)	S. W. Arnold	Cortland, Ill.
22	Nova Scotia corn	C. H. Pitman	North Barnstead, N. H.
22	New York peas	do	Do.
22	Rape seed, (winter and spring varieties)	Ferdinand Stoesser	Sheboygan, Wis.
22	Specimen of Sea Island cotton	E. P. Walker	Hayti, West Indies.
23	Currant roots	Governor Doty	Utah Territory.
24	Grape cuttings	F. R. Elliott	Cleveland, Ohio.
24	Crystal White blackberry, (specimen)	do	Do.
24	Grape cuttings, fine assortment of foreign and native varieties.	Wm. Fowler	Baltimore, Md.
24	Grape cuttings	Jacob R. Garber	Columbia, Pa.
26	Corn, superior new variety	D. N. Smith	Coldenham, N. Y.
1863.			
Jan. 2	Grape cuttings, superior assortment of foreign and native varieties.	C. Campbell, gardener for T. Winans, esq.	Baltimore, Md.
3	Grape cuttings	J. K. Whildin	Wilmington, Del.
5	Sugar made from the imphee plant	Jonathan H. Smith	Quincy, Ill.
10	Grape cuttings	Henry E. Rogers	South Manchester, Ct.
10	Hybrid grape cuttings	George W. Campbell	Delaware, Ohio.
12	Grape cuttings, (Bates seedling)	W. R. Chapman	Mount Holly, N. J.
15	Samples of sorghum sirup, imphee and beet sugar.	Wm. H. Belcher	Chicago, Ill.
20	Japan peas	Daniel Fraser	Mount Lebanon, N. Y.
24	Specimen of beet sugar	W. H. Osborne, president, &c.	Chicago, Ill.
26	Grape cuttings	Dr. H. Schroeder	Bloomington, Ill.
28	Currant cuttings	M. C. Read	Hudson, N. Y.
Feb. 6	Upland rice	Hon. R. H. Pruyn, United States minister.	Yeddo, Japan.
6	Grape cuttings	do	Do.
6	Grape cuttings	Thomas Hogg, esq., United States marshal.	Kanegawa, Japan.
9	Grape cuttings, Hugh's variety	James A. Nelson	Mercer, Pa.
13	Grape cuttings	John Read	Huntingdon, Pa.
13	Seeds of the perfected tree tomato	do	Do.
14	Maxatawney grape buds from the original plant.	J. E. Mitchell	Philadelphia, Pa.
14	Flickwer's seedling grape cuttings	do	Do.
14	Creveling grape cuttings	do	Do.
25	Grape cuttings	J. H. Sullivan	Bell Air, Ohio.
Mar. 1	Specimen of native cotton	R. J. Treffrey	Honda, New Granada.
1	Variety of fine garden seeds	Charles Ketchum	Penn Yan, N. Y.
1	Specimen of cotton grown in Pennsylvania	John Oliphant	Fayette county, Pa.
4	Tuscarora corn	E. B. Bartlett	Vermillion, N. Y.
5	Red sorghum seed	C. A. Francke	Clinton county, Iowa.
5	German sugar pea	do	Do.
5	Black sorghum seed	do	Do.
5	Specimens of indigo, cotton, wheat, corn, and beans.	A. Ainsa	Hermosillo, Mexico.
8	Specimens of cotton grown in Iowa	Hugo Beyer	New London, Iowa.
8	Specimens of cigars made of Iowa tobacco	do	Do.
8	Superior assortment of garden seeds, (10 varieties.)	do	Do.
10	Interesting specimens of fossil shells	T. McK. Wilson	Washington city, D. C.
10	Cotton grown in Maryland	John Underhill	Howard county, Md.
12	Variety of garden seeds	Julius Hillscher	Cordova, Minn.
12	Sample of poppy seed	do	Do.
14	Superior Hubbard squash seed	Joel W. Smith, secretary, &c.	Charles City, Iowa.
14	Fine assortment of superior vegetable seeds	Society of Shakers	New Lebanon, N. Y.
20	Native grape cuttings	J. M. Matson, secretary	Melbourne, Australia.
23	Tobacco seed	C. Hoffman	Fremont City, Iowa.
23	Chicory seed	do	Do.
23	Grape cuttings	Wm. Morris Cooper	Moorestown, N. J.

Date.	Articles donated.	From whom.	Residence.
1863.			
Mar. 23	Grape cuttings	S. H. Kridlebaugh, M. D.	Clarinda, Iowa.
23	Dwarf broom-corn seed	do	Do.
26	Specimen of cotton grown in Ohio	Mrs. M. A. Newburg	Clinton county, Ohio.
27	Grape cuttings	George W. Martin	Madisonville, Ohio.
30	Ornamental tree seeds	W. C. Hampton	Mount Victory, Ohio.
31	Currant cuttings	Daniel Graves	Provost, Utah Ter.
31	Samples of superior pole beans and sugar-corn	John P. Youlen	West Rupert, Vt.
31	Vanilla grape cuttings	Mrs. T. R. Ingram	Philadelphia, Pa.
Apr. 4	Models of machinery for irrigating purposes	C. G. Grabo	Detroit, Mich.
4	Samples of Siberian wheat and Canada corn	C. H. Pitman	North Barnstead, N. H
4	Samples of Hubbard squash and California mustard seed.	do	Do.
4	Superior vegetable seeds	C. G. Grabo	Detroit, Mich.
4	Flower seeds	J. Fill	Bladensburg, Md.
5	Dario grape seed	J. Augustus Johnson, United States consul.	Beirut, Asia.
8	Grape cuttings	John G. M. Thalb	Pomona, Va.
10	Pearl pop-corn	E. S. Phelps	Wyanet, Ill.
13	Copper Mine grape vine	R. O. Thompson	Syracuse, Nebraska Ter.
13	Grape cuttings	do	Do.
13	Currant cuttings	do	Do.
13	Flower seeds	do	Do.
17	Grape cuttings	Benjamin Hill	East Line, N. Y.
17	Russell's prolific strawberry plants	do	Do.
18	Specimen cottonized flax	Brothers Ofirhiver	Hirschburg, Bohemia.
25	Specimen swamp flax	Rev. Chas. A. Kempffer	Beaver Spring, Pa.
May 5	Monastery pink seed	Francis Shoemaker	Cordova, Minn.
5	Siberian larkspur	John G. B. Smith	Kingston, N. Y.
5	Tahiti tree cotton seed	Mechanic's Institute	San Francisco, Cal.
7	Seeds of the lochosa, a species of the palm	C. H. Loehr, United States consul.	Ciudad de Bolivar, Venezuela, South America.
13	Sample of the coffee bean	H. E. Seymour	St. Alban's, Vt.
13	Sample of the cottonized flax	C. C. Williams	Oswego, N. Y.
22	Genuine medicinal chamomile seeds	Adolph Meggenhofen	Bellasylva, Pa.
22	Red foxglove seed	do	Do.
22	Genista seed	do	Do.
25	Alfilaria, or pingrass seed	Alexander S. Taylor	Santa Barbara, Cal.
28	Interesting specimen of cottonized swamp flax.	C. C. Williams	Oswego, N. Y.
30	Specimen seeds of watermelon and other delicious fruits grown in Nicaragua.	Hon. Thos. H. Clay, United States minister.	Leon, Nicaragua.
June 6	Specimens of native cotton	Jonathan Elliot, late United States consul.	San Domingo.
30	Valuable specimens of native seeds	Charles H. Loehr, United States consul.	Ciudad de Bolivar, Venezuela, South America.

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